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BIOLOGICAL EVALUATION OF PEST CONDITIONS AT SILVER LAKE RECREATIONAL AREA, AMADOR RANGER DISTRICT, ELDORADO NATIONAL FOREST

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ABSTRACT

The vegetation in several recreation and special use areas around Silver Lake, Amador Ranger District, was examined for pests, hazardous and potentially hazardous defects, and health and vigor. The District is considering some vegetation management activities and desired the input of the Forest Pest Management staff to their environmental assessment. In general, the stands are comprised largely of overmature red fir with smaller components of lodgepole pine, white fir, western white pine, western juniper, and aspen. The principal pests are red fir and lodgepole pine dwarf mistletoes, annosus root disease, and a variety of tree defects mainly involving decay. In addition to the pests that are present, overstocking is a common situation that will lead to insect-related mortality. Management alternatives are discussed for the recreation complex that provide pest management information as an integral part of overall resource management. These broad, resource-oriented management alternatives can incorporate pest-specific management alternatives that are also presented.

INTRODUCTION

At the request of the Forest Supervisor, Eldorado National Forest, we examined the recreation complex surrounding Silver Lake on the Amador Ranger District. This complex includes Silver Lake Campgrounds East and West, Kit Carson Resort, Camp Silverado, Camp Minkalo, Stockton Municipal Family Camp, Silver Lake Summer Home Tract, Plasses Summer Home Tract, and surrounding stands. The total area of the complex is approximately 500 acres.

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On August 4, 1986 we met with Glenn Gottschall, District Ranger, and Stewart Craig, District Silviculturist, to discuss the objectives for the recreation complex and the purpose of our visit. The primary objective for the area is to maintain or improve tree vigor in the areas of highest public use. The District has started an environmental assessment for a timber sale to achieve this objective. The silvicultural objective being developed is to utilize an uneven-age management system using single tree selection and possibly group selection with limitations of 1/2- to 3/4-acre group size. This will meet the visual quality objective of retention and respond to initial public concerns. The purpose of our visit was to provide input to the assessment on the occurrence and effects of pests on the vegetation and the potential hazards to the public and property from trees with defects.

The field work occurred on August 4-8 and October 20-22, 1986. Mapping of specific pest locations was done on site maps that are enclosed with this report. Because of the administrative complexity of the recreation area, the vegetation and conditions on each distinct unit are described separately. Management alternatives are then presented and discussed for groups of units that would respond similarly to such actions.

OBSERVATIONS

Silver Lake Campground East

Much of the campground supports a two-story stand with large, sawtimber-size, old-growth red fir the principal species in the overstory. Smaller components of white fir, Jeffrey pine, and western white pine are scattered through this overstory layer. The understory contains red fir, white fir, western white pine, and lodgepole pine in the wetter areas. In wet areas around Oyster Lake, the lodgepole pine component increases to essentially a single species stand. The primary brush species are whitethorn and grasses with some Ribes. Stocking density and regeneration of conifer species varies in the campground. In certain areas, sites support an old-growth overstory with essentially no regeneration or brush species. Other areas are overstocked with dense aggregations of sapling and pole-size trees surrounding larger trees.

Measurements consistently determined the site quality to be a Schumacher 40. Soils appeared to be deep, with some scattered basalt and other rock outcrops.

Red fir dwarf mistletoe (Arceuthobium abietinum f. sp. magnificae) was prevalent in the red fir in most of the campground. Branch flagging was severe in the overstory in some areas and infection levels in individual trees were high. Branch flagging was likely caused by Cytospora abietis, a common associate of red fir dwarf mistletoe, that causes a canker at the site of dwarf mistletoe infections. Understory red fir were also commonly infected by dwarf mistletoe.

Conks of the Indian paint fungus (Echinodontium tinctorium) were common on the red and white fir in the stand. Even smaller, suppressed individuals had conks. The size, number, and distribution of conks on boles indicates that substantial heart rot is present in the stand.

Two stem rusts were present in the campground. Western gall rust (Endocronartium harknessii) was infecting lodgepole pine, causing hip cankers on the boles of pole-size and larger trees. White pine blister rust (Cronartium ribicola) was causing branch and twig mortality of western white pines up to pole-size. This disease will result in mortality of the smaller size classes of infected white pines.

Conks of Fomes annosus were identified in stumps of red fir throughout the campground. This fungus can cause annosus root disease which expresses itself as a root and butt decay in true firs. This may result in tree failure. Damage may have occurred in some areas of the campground, illustrated on the enclosed map, from this disease.

In addition to the decay defects caused by Indian paint fungus and annosus root disease, other defects were common on overstory red and white firs that could lead to tree failure and potential hazard to people and property. These defects were usually associated with decay. Defects included basal wounds, bole cankers, broken and dead tops, and leans. Specific instances are recorded on the enclosed map and described in the key at the end of this report.

Silver Lake Campground West

This campground, on the west side of Highway 88, is on a rocky, shallow soil. Lava mud flows and large granite outcrops are present. The overstory is comprised of red fir, white fir, Jeffrey pine, lodgepole pine, and western juniper. The size of the overstory is about the same as in the east campground. Understory species include red fir, white fir, and lodgepole pine with patches of lupine and whitethorn; the latter especially in openings. Two pockets of lodgepole pine exist; one extends from the campground entrance along Highway 88 down to the Silver Fork, and the other is in the vicinity of site 82. Western juniper is found on the dry, rocky, exposed sites on the western and northwestern boundary of the campground. White fir appears to make up a larger proportion of the overstory than in the east campground, although red fir is still the principal species.

Red fir dwarf mistletoe is distributed throughout the campground in the overstory and understory. Branch flagging and bole cankers are associated with this disease in the overstory. Lodgepole pine dwarf mistletoe (Arceuthobium americanum) is present in scattered areas as indicated on the map. Witches' brooms are a common symptom of infection of this disease in the campground. A true mistletoe (Phoradendron juniperinum ssp. juniperinum) infects some of the western juniper.

Western gall rust had produced hip cankers on the boles of some lodgepole pines at heights of 20 to 30 feet. Although not of immediate concern as a mortality factor, these bole deformities can be areas of weakness that are subject to failure, making the trees potentially hazardous. Some lodgepole pines also had white pitch tubes on their boles indicating recent, unsuccessful attacks by mountain pine beetle (Dendroctonus ponderosae).

Stocking in parts of the campground is excessive. Saplings and poles of red and white firs are densely clumped, with or without overstory trees, in much of the campground. A symptom of the stress this is causing is the activity of the fir engraver (Scolytus ventralis). Resin streaming in the upper bole and patch

killing of the cambium are indicative of attempts by this beetle to overcome these trees. Another possible indicator of overstocking was a white fir in the overstory near site 80. Although the foliage was green, there was red and white sawdust at the base of the tree, indicating that the tree was dead. Closer examination revealed roundheaded fir borers (Tetropium abietis) and ambrosia beetles (probably Platypus sp.) in the base which suggests that fir engravers had attacked higher on the bole. Mycelial fans of the fungus Armillaria sp. were found at the root collar. The presence of these pests usually indicate that the tree was under stress and competition is a likely cause.

As in the east campground, conks of F. annosus were common in the stumps of red and white firs. Above ground damage from this disease was not observed. Similar types of tree defects were also observed in the red and white firs that could lead to failures. The number of trees with conks of Indian paint fungus was much less, however.

Kit Carson Resort

The Kit Carson Resort is a special use facility operated by a permittee. It is situated between Silver Lake East Campground and Silver Lake. Physical improvements include a lodge, dining room, store, cottages, and necessary facilities to maintain and operate the resort.

The overstory in the resort area contains red fir with some white fir and lodgepole pine. These trees are generally of a smaller size class, medium sawtimber, than what is in the adjacent campground. A few predominant Jeffrey pines are scattered in the overstory.

Red fir, white fir, and lodgepole pine make up the understory. The understory in parts of the stand has excessive stocking densities.

Dwarf mistletoe is present in the red fir around the resort. The intensity of infection decreases in the cottage area down to the beach. As in other areas, branch flagging and bole cankers are common symptoms of infection in the resort area. Conks of F. annosus were observed in red fir stumps. In two situations, dead white fir seedlings or saplings were near such stumps, with evidence of the fungus on their roots. Some insect activity was noted on red fir. One tree had woodpecker and roundheaded borer activity at the base and resin streaming in the upper bole, suggesting that the tree will probably not survive. Resin streaming in the upper bole of some understory red firs was observed, indicating attacks by fir engraver. As discussed for other areas with large true firs, defects that could lead to tree failure and potential hazard were observed near some structures.

East Silver Lake Summer Home Tract

This set of special use permittee tracts is located on the east side of Silver Lake at the north end of the lake. It continues from the east campground and Kit Carson Resort and runs along the lake. There are 55 tracts, with physical improvements, including cabins and other structures.

The vegetation around the summer homes is similar to most of the east campground with large overstory red fir mixed with a smaller proportion of

white fir. Many of these large trees have some type of defect that could lead to tree failure. Failures have recently occurred in the area, primarily from one of two types of defects. Most recently, windthrow of large red fir has occurred because of the loss of structural roots from decay. Two root-rotting fungi were involved in this, Fomes annosus and Armillaria sp. The second defect was top kill of large trees and subsequent decay. Top kill is common and has led to replacement by volunteer tops. The dead tops have broken off throughout the area, but it was more pronounced from tracts 22 through 26 and 92. In this area, even smaller trees have broken off at 10 to 20 foot heights. This area appears to be subjected to strong winds across the lake, increasing the probability of failure.

Pests in the summer home tract are the same as those discussed for the campground. Red fir dwarf mistletoe is common and severe in many of the large overstory trees. As previously mentioned, two root rots are present in both species of fir. The Indian paint fungus is causing bole decay in red and white fir. The fir engraver has attacked both species of fir and caused mortality, patch and strip kills, and top kill. The roundheaded fir borer was associated with this activity, especially in dead and dying trees.

Camp Silverado

This facility is operated on a special use permit by the Boy Scouts of America. Physical improvements include a lodge/dining facility, cabins, latrines, tent pads, and support facilities. Trails and a primitive road/trail system weave throughout the area.

The stand is comprised of large overstory red fir and a few Jeffrey pines. White firs are present as codominant, intermediate, and suppressed individuals in the canopy. Regeneration is not common.

Red fir dwarf mistletoe is the prinicpal pest in this stand. Branch flagging, bole cankers, and witches' brooms were common in much of the overstory red fir. The understory red fir were also infected by dwarf mistletoe. Bole breakage was common in certain areas, especially around the parking lot. Conks of F. annosus were found in red fir stumps in several locations. Mortality of red fir was observed in the vicinity of some of these stumps. Defects that could cause tree failures included basal cavities, dead limbs and witches' brooms, bole cankers, forks, heart rot, and leans.

Camp Minkalo

Camp Minkalo is a special uses campground operated by the Campfire Girls. A number of structural improvements have been built on the site. Much of the site is rocky with exposed bedrock. A small stream, Squaw Creek, runs through the campground to Silver Lake. Much of the vegetation is near this stream and in other pockets where the soil is deeper.

Lodgepole pine is the common tree species. A few Jeffrey pines and western white pines are scattered in the area. Alder, red fir, and a few mountain hemlock occur near the creek. On the rocky sites where little other tree cover exists, western juniper can be found. Although the vegetation in the exposed rocky areas is sparse, in areas with deep soil, tree density is high.

The lodgepole pines throughout the campground are heavily infected by dwarf mistletoe and witches' brooms are common. Mountain pine beetles have attacked some of the lodgepole pines, resulting in some tree mortality. Bark beetle activity was associated with dwarf mistletoe infection and overstocking, but the insects did not appear to be very successful in tree killing or brood production. A dense aggregation of suppressed red fir had been attacked by the fir engraver and included dead and dying trees.

Plasses Summer Home Tract

The Plasses summer home tract is a string of summer cabins along the Plasses Alpine Highway at the southwestern end of Silver Lake. There are 24 tracts in this development and all of them have some type of cabin or house. The tracts are situated on a shallow bench of soil above a rock outcropping that gradually drops to lake level. Above the tract is another rock outcropping.

An old-growth red fir and lodgepole pine stand is situated on this shallow bench. The canopy is primarily 1- and 2-layered. Regeneration is not common. Stocking densities are high and many of the trees are located close to physical improvements, either structures or roads.

Many of the red fir in the central part of the area are being attacked by insects. Pitch streaming and red and white sawdust were seen on a number of red fir with green crowns. These trees are infested with the fir engraver and probably the roundheaded fir borer and their foliage will fade next spring. This area, from tracts 7 through 16, has lost and will continue to lose red fir to insects because of high stocking, compaction, a disturbed fragile site, overmaturity, and other stress factors. Even on living trees, there is pitch streaming from the upper bole indicating repeated, but yet unsuccessful, attacks by fir engravers.

At the northern end of the tracts, numbers 95-98, the vegetation changes to a lodgepole pine stand. The site is rockier and probably there is less soil. Stand density is high. Dwarf mistletoe is present and is severe in some of the trees. There is evidence of mountain pine beetle activity, although they have not yet been as successful as fir engraver in other parts of the home site.

Because of their age and size, both species of tree in this area have a variety of defects that could result in failures. Defects observed included decay, basal wounds, dead tops, forks, and leans.

Stockton Municipal Family Camp

This large special uses resort campground is located south of Silver Lake. It is operated by the city of Stockton for public use. General use facilities include a lodge, kitchen, offices, shower, and museum. Scattered through the area are permanent cabins and tent cabins.

Two types of vegetation exist in the area. Riparian vegetation with willows is along South Stream. On the flat that borders the stream is an even-age stand of lodgepole pine with scattered larger lodgepole pine and red fir predominants. The large red fir are growing on soil hummocks. Underneath the overstory, red fir are regenerating on the site.

The remaining area beyond the direct influence of the stream supports a dense stand of red fir and lodgepole pine, with a scattering of Jeffrey pine, white fir, and western white pine. A multi-storied stand is present with the two fir species comprising most of the understory. Large red firs dominate the canopy with lodgpole pines generally as intermediates and codominants.

The lodgepole pine in the camp had several pests. Patches of lodgepole pine dwarf mistletoe are present. In the purer stand of lodgepole pine along the stream, two rust cankers can be found, western gall rust and stalactiform rust (Peridermium stalactiforme). Trees may be killed by both of these diseases, but mortality usually occurs many years after infection. Western gall rust is more of a concern because of the bole deformities usually produced and the potential for tree failure. Pitch tubes from unsuccessful mountain pine beetle attacks were also common on lodgepole pine.

Tree hazards and overstocking are the principal concerns in red fir. There are some red firs around cabins V and W infested by red fir dwarf mistletoe. The defects of significance are the same as those seen in other parts of the recreation area where large, overmature red fir were observed. The presence of cabins in the campground increases the hazard potential of many of these trees.

Although western white pine is a small component of the stand, white pine blister rust was observed on some saplings and threatens any white pine regeneration.

BIOLOGY OF PEST ORGANISMS

RED FIR DWARF MISTLETOE (Arceuthobium abietinum f.sp. magnificae). Red fir dwarf mistletoe is a seed-bearing plant that parasitizes only red fir. It will not survive without living host tissue, which it depends on for support, food, nutrients, and water.

Dwarf mistletoes initiate their life cycle when a seed lands on a needle or small twig of a host. The seed is coated with viscin, a sticky substance that allows it to adhere to the host tissue. During rains, the viscin becomes mucilaginous, allowing the seed to slide down to the needle base where it may lodge. The seed germinates in the winter or spring and the radicle grows along the twig until it reaches a needle base or bark irregularity. The radicle forms a holdfast and penetrates the twig into the xylem. A type of root system then develops in the twig. In 3 to 5 years from seed deposition, most successful infections will appear as branch swellings and will bear mistletoe shoots. These shoots will not produce fruit until at least 5 years following seed deposition, the average being 8-9 years. Fruit mature in the fall and disseminate seed in September and October. The seeds are explosively discharged from the fruit through the buildup of turgor pressure. Seeds normally have an upward trajectory.

Red fir dwarf mistletoe does not spread rapidly following establishment. Vertical spread in a tree averages less than 3 inches per year. Horizontal spread in a stand without overstory infection is also quite limited. The dense foliage of red fir limits spread because of the high probability of interception of the seed. Spread from infected overstory to understory may be up to about 100 feet, but it is usually less; the actual distance is dependent on slope, wind, and other factors. Trees less than 3 feet tall have a very limited chance of infection because of their small target size.

ANNOSUS ROOT DISEASE (Fomes annosus). Fomes annosus is a fungus that attacks a wide variety of woody plants. All western conifer species are susceptible. Madrone (Artemisia menziesii), and a few brush species (Arctostaphylos spp. and Artemisia tridenta) are occasional hosts. Other hardwood species are apparently not infected. The disease has been reported on all the National Forests in California, with incidence particularly high on true fir in northern California campgrounds. Incidence is somewhat higher in older fir stands with large trees and in stands with high basal areas (over about 330 square feet/acre).

During periods favorable to the fungus, fruiting bodies (conks) form in decayed stumps, under the bark of dead trees, or under the duff at the root collar. New infection centers begin by aerial spread of spores produced by the conks and subsequent colonization of freshly cut stump surfaces or wounds on living trees. The fungus then spreads through root contacts into the root systems of adjacent live true fir. Local spread of the fungus from a stump typically results in the formation of a disease center, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach natural barriers such as stand openings or non-susceptible plants.

In pines, F. annosus grows through root cambial tissue to the root crown where it girdles and kills the trees. In less resinous species, such as true firs, the fungus sometimes kills trees, but more frequently it is confined to the heartwood and inner sapwood of the larger roots where it causes a chronic butt and root decay and growth loss. Thus, while infection in true fir usually does not kill the host, it does affect its growth and thriftiness. Losses in true fir from F. annosus are mainly the result of windthrow resulting from root decay, and reduced root systems which predispose trees to attack and eventual death by the fir engraver beetle. Field observations suggest that vigorous young firs are usually able to regenerate root tissues faster than they are lost to the root disease. But when true firs slow in growth because of stand and/or site conditions, root development decreases to where there is a net loss in roots and the trees slowly decline due to the gradual loss of their root systems. This decline may take 10 to 20 years before tree death occurs.

In general, infections will cross from roots of pine to roots of true fir; however, rarely is the fungus observed to cross from true fir to pine. At higher elevations where pine and true fir are intermixed, F. annosus is commonly found only on true fir and mortality rarely includes both species within an infection center.

INDIAN PAINT FUNGUS (Echinodontium tinctorium). The primary hosts of this fungus in California are the true firs. Infection results in a brown stringy rot of the heartwood that may result in a hollow being formed. Conks of the fungus are very distinctive, being dark and woody with a rust red interior. The lower surface has hard, coarse teeth or spines while the upper surface is black and rough. When a tree bears two or more conks that are separated by more than 10 vertical feet, then extensive decay of the heartwood is present. Individual conks less than 6 inches across usually indicate that the decay has not reached the advanced stringy stage.

Infection occurs when spores germinate on stubs formed from the breaking of shade-killed branchlets less than 1 mm in diameter. These stubs are overgrown by new wood and the fungus remains quiescent for up to 50 years causing no decay. It is postulated that the formation of large branch stubs or wounds may cause reactivation of the fungus, resulting in decay.

FIR ENGRAVER (Scolytus ventralis). The fir engraver attacks both white and red fir in California. Trees ranging in size from large saplings to overmature sawtimber are susceptible. Attacks can cause patch-killing of cambium along the bole, top-kill, or tree death. Top-kill or death occur most often in firs that have been weakened by root disease, dwarf mistletoe, overstocking, soil compaction, sunscald, logging injury, or drought. The fir engraver also breeds in slash and windthrown trees.

The fir engraver usually completes its life cycle in one year, sometimes two. Adults fly and bore into trees or green fir slash from June to September; larvae, pupae, and adults over-winter under the bark. Pitch tubes are not formed as they are with pine bark beetles; the usual evidence of attack is boring dust in bark crevices along the trunk and pitch streamers on the mid and upper bole. Trees colonized early in the summer may begin to fade by early

fall, but those colonized later in the year usually do not fade until the following spring or summer, often after the beetles have emerged.

LODGEPOLE PINE DWARF MISTLETOE (Arceuthobium americanum). Lodgepole pine dwarf mistletoe is a parasitic, flowering plant that can only survive on living lodgepole pines in California. They obtain most of their nutrients and all of their water and minerals from their hosts.

Dwarf mistletoes spread by means of seed. In the fall the fruit ripen and fall from the aerial shoots. The seeds are forcibly discharged. The seed is covered with a sticky substance and adheres to whatever it contacts. When a seed lands in a host tree crown, it usually sticks to a needle or twig, where it remains throughout the winter. The following spring the seed germinates and penetrates the twig at the base of the needle. For the next 2-4 years, the parasite grows within the host tissues, developing a root-like system within the inner bark and outer sapwood, and causing the twig or branch to swell. Aerial shoots then develop and bear seed in another 2-4 years.

Dispersal of dwarf mistletoe seeds is limited to the distance the seeds travel after being discharged. From overstory to understory, this is usually 20 to 60 feet, but wind may carry them as far as 100 feet from the source. A rule of thumb is that the seeds can travel a horizontal distance equal to the height of the highest plant in an infected tree. There is some evidence that long distance spread of dwarf mistletoe is occasionally vectored by birds and animals. Vertical spread within tree crowns of most dwarf mistletoes is limited to less than one foot per year because of foliage density.

Dwarf mistletoes are easy to identify because they are generally visible within a tree's crown. Signs of infection include the yellow-green to orange mistletoe plants, basal cups on a branch or stem where the plants were attached, and detached plants on the ground beneath an infected tree. Symptoms include spindle-shaped branch swellings, witches' brooms in the lower crown, and bole swellings.

WHITE PINE BLISTER RUST (Cronartium ribicola). White pine blister rust is caused by an obligate parasite that attacks sugar and western white pines and several species of Ribes. The fungus needs the two alternate hosts to survive, spending part of its life on 5-needled pines and the other on Ribes. The disease occurs throughout the range of sugar pine to the southern Sierra Nevada, but has not been reported further south. Infection of pines results in cankers on branches and main stems, branch mortality, top kill, and tree mortality.

Spores (aeciospores) produced by the fungus in the spring on pine bole or branch cankers are wind-disseminated to Ribes where they infect the leaves. Spores (urediospores) produced in orange pustules on the underside of the leaves reinfect other Ribes throughout the summer, resulting in an intensification of the rust. A telial spore stage forms on Ribes leaves in the fall. Teliospores germinate in place to produce spores (sporidia) which are wind-disseminated to pines and infect current year needles. Following infection, the fungus grows from the needle into the branch and forms a canker. After 2 or 3 years, spores are produced on the cankers and are spread

to Ribes to continue the cycle. Although blister rust may spread hundreds of miles from pines to Ribes, its spread from Ribes back to pines is usually limited to a few hundred feet.

Branch cankers continue to enlarge as the fungus invades additional tissues and moves toward the bole. Branch cankers within 24 inches of the bole will eventually form bole cankers. Bole cankers result in girdling and death of the tree above the canker. Cankers whose closest margins are more than 24 inches from the main bole are unlikely to reach the bole and only branch flagging will result.

Environmental conditions are critical for successful infection and limit the disease most years. Moisture and low temperatures favor infection of both hosts, and must coincide with spore dispersal for infection to occur. In California, these conditions occur only infrequently, usually in cool moist sites such as stream bottoms or around meadows. In so, called "wave years" when favorable conditions occur, high levels of ifnection can result. Wave years in California have occurred at approximately ten-year intervals in the past. As one moves from sites most favorable for rust to less favorable sites, the frequency of wave years decreases.

MOUNTAIN PINE BEETLE (Dendroctonus ponderosae). The mountain pine beetle attacks the bole of ponderosa, lodgepole, sugar, and western white pines larger than about 4 inches dbh. Extensive infestations have occurred in mature lodgepole pine forests. Group killing often occurs in mature forests and young overstocked stands of ponderosa, sugar, and western white pines.

The life cycle of the mountain pine beetle varies considerably over its range. One generation per year is the general rule, with attacks occurring from late June through August. Two generations per year may develop in low elevation sugar pine.

Attacks may extend from the root collar up to near the top. Pheromones released during a successful attack may attract enough beetles to result in a group kill. Pitch tubes and red boring dust in bark crevices or on the ground indicate successful attacks.

The adults bore long vertical egg galleries and lay eggs in niches along the sides of the gallery. A "J"-hook is common at the lower end of the gallery. The hatching larvae feed in mines perpendicular to the main gallery and construct small pupal cells at the end of these mines where they pupate and transform into adults.

The sapwood of successfully attacked trees soon becomes heavily bluestained. The bluestain fungi probably aid in overcoming the defenses of the host tree.

Natural factors affecting the abundance of the mountain pine beetle include low winter temperatures, nematodes, woodpeckers, and predaceous and parasitic insects. As stand susceptibility to the beetle increases because of age, overstocking, diseases, or drought, the effectiveness of natural control decreases and mortality increases. Relieving stress by thinning dense stands can prevent some group kills. Individual high value trees undergoing temporary

reversible stress may be protected from attack by application of insecticide to the bole.

CYTOSPORA CANKER (Cytospora abietis). Cytospora abietis is a canker-causing fungus that infects true firs throughout their range in California. It is a weak parasite, and usually attacks trees that have been weakened by disease, drought, fire, insects, or human disturbance. It is most commonly associated with dwarf mistletoe infection, and sometimes attacks as many as a quarter of the mistletoe-bearing branches, killing many each year. The bright red flags of recently-killed branches on dwarf mistletoe-infected red firs are almost always the result of lethal Cytospora infections. C. abietis occasionally reaches especially damaging proportions in certain years, and may attack trees of any age, sometimes killing the tops or all of young trees.

STALACTIFORM RUST (Peridermium stalactiforme). This rust fungus attacks lodgepole, Jeffrey, and ponderosa pines. It causes limb rust of Jeffrey pine and main stem cankers of ponderosa and lodgepole pines. These pine hosts support production of orange aeciospores in the spring that are windborne to the alternate hosts, members of the figwort family. Two spore stages develop consecutively on the foliage of these alternate hosts. Basidiospores are formed on these hosts in the fall and are wind disseminated short distances to infect pine needles. The fungus then grows down into the pine branch and is perennial.

Infected Jeffrey pines have symptoms of limb rust with individual branches in the lower crown having cankers and dying. These symptoms spread upward in the crown. The fungus causes an elongated, sunken canker on lodgepole pine that usually bleeds resin profusely.

WESTERN GALL RUST (Peridermium harknessii). Western gall rust causes branch galls and trunk cankers on nearly all species of hard pines. The rust fungus produces yellow to orange-colored spores (aeciospores) on the surface of the galls during cool, moist, spring weather. The spores are wind disseminated and can infect other pines directly. Invasion of the pine bark by the rust fungus results in the formation of woody galls. Galls on branches are typically subglobose or spindle-shaped. The galls continue to enlarge and produce new spores each spring until they have girdled and killed the branch or stem. Girdling of branches results in a reduction of tree growth. Trunk cankers deform and reduce the strength of the bole.

MANAGEMENT ALTERNATIVES

Management alternatives are presented in two formats. The first series are designed to provide pest management direction for the entire recreation complex. Although specific pests are mentioned, control methods for individual pests are not included in these discussions. The purpose of these alternatives is to provide pest management information that can be integrated into overall resource management objectives. The second series of alternatives provide pest-specific management direction that can be included under one or more of the resource management-oriented alternatives.

Areas with generally similar vegetation and pests have been grouped to simplify the display of alternatives and reduce repetition. While sharing some similarities, these areas are certainly not homogeneous. Even within a given campground or special-use tract, the largest plant aggregation that would respond in a uniform manner to a treatment would be no more than a few acres. Management actions should be developed utilizing the following pest management information on a site-specific basis to achieve management objectives.

Pest Management as Part of Resource Management

1. **DO NOTHING.** Tree failures will continue to occur and the incidence may increase. Red and white firs will be especially susceptible to root and stem failures because of decay. Some property damage could occur. Personal injury may occur, but has a lower probability than property damage because of seasonal occupancy. Failures are most likely during the winter from storms, snow loading, and saturated soils.

Dwarf mistletoe will intensify in the red fir overstory and further reduce the vigor of these overmature individuals. Infections in these overstory trees will continue to discharge seed that will infect understory red fir. These infections, especially in the upper crown, will retard height growth. This, in conjunction with shading, will result in suppressed trees of poor vigor that may never become acceptable replacement trees. Although red fir dwarf mistletoe is already widespread in the area, it will continue to spread into adjacent uninfected areas.

Lodgepole pine dwarf mistletoe will intensify and reduce the vigor of infected trees, especially those with many large witches' brooms. This will increase the probability of successful mountain pine beetle attacks and mortality of lodgepole pine. Some of this activity has already occurred at Camp Minkalo and the situation will be exacerbated there because of overstocking.

Stocking levels are high in many areas of the recreation complex. These levels will increase and result in increasing stress on the trees as they compete for moisture and light. Chronic levels of mortality will occur, especially in dense aggregates. All size classes will be affected. During periods of drought, higher levels of mortality can be expected. In addition to tree mortality, top-killing of red and white firs will occur from attacks by fir engraver, especially of larger trees.

The long-term prognosis will be a stand with a few scattered large trees over an uneven canopy. Trees of all size classes will remain in the stands,

although seedling regeneration may be limited. Openings of various sizes will be common and interspersed among dense aggregations of suppressed, deformed, and diseased trees. Hazards from failures of large trees will increase during this period until most of the large trees are gone, then hazards will become less significant because of smaller tree sizes, although failures may be just as common because of the amount of decay and defect.

2. **HAZARDOUS TREE MANAGEMENT.** A hazardous tree management program would be initiated in the recreation complex with the objective of reducing the number of tree hazards to an acceptable level, thereby, reducing the probability of damage to property and risk to public safety. Such a program would require an initial inspection to determine the locations of hazardous trees and to prescribe any actions necessary to reduce the hazard. In most cases, this would be tree removal, but other measures, such as topping, pruning, bracing, and relocating improvements, may be appropriate depending on the specific situation. This inspection and any actions taken should be documented.

Once initiated in an area, a hazardous tree management program should be a continuous process with periodic reinspections and subsequent actions, when necessary. These activities should be documented, both for legal purposes and for determining if changes in hazard are occurring in individual trees.

Because of the large area involved, a hazardous tree management program could be initiated in various parts of the complex over time. This would require prioritizing areas for treatment. Two criteria from strictly a hazard reduction consideration should be used in establishing these priorities. The amount of defect and its likelihood of resulting in failure should be considered. Areas with considerable root and butt decay, dead tops, leaning trees, and trunk rots would have a high priority. The second consideration should be toward the amount of damage that could result if failures did occur. Tree size is an important character involved since larger trees have a larger target area and the resultant damage may be greater. Also, the value of the targets may influence the priority for treatment.

The results of a hazardous tree management program on the vegetative characteristics in the recreation area will depend on the levels of hazard deemed acceptable and the intensity of activity undertaken. An active program in many areas of the complex could result in a substantial loss of tree cover because of the number of hazardous trees and the expected damage from felling many of the large trees. Small openings may be common at the north end of the lake. Subsequent windthrow of trees around these openings may occur because of undetected root decay in the true firs and changes in wind patterns and exposure of tree crowns. A greater vegetative component could be retained, at least for the short term, by being conservative in selecting trees for removal for hazard reduction.

3. **SANITATION/HAZARD REDUCTION.** An individual tree survey would be done to identify defective trees that have the potential to cause damage or injury. Through a tree hazard management program, risks to people and property would be reduced to acceptable levels. Because of the size of many of the trees and the amount of defect in the stand, the initial actions would result in the removal of many of the trees in the stand. This is especially true in the areas at the north end of the lake where the stands are heavily stocked with large, overmature red firs.

The removal of many trees over a short period of time could cause several additional problems. Because of the size of the trees, associated logging damage from felling and skidding could be excessive. This would add to future hazard concerns. Removing many of the trees could reduce the structural support provided by the intact stand. Residual trees would be exposed to different wind forces and with their lack of adequate root development, they could fail. Also, undetected defects, especially root decay, could become involved in significant numbers of failures.

Some disease and stocking problems would be eased by removing hazardous trees. Some of the large red fir infected by dwarf mistletoe would be removed, thereby reducing, but not eliminating, the intensification and spread of the disease. Any tree removal would lessen the stocking level, although it may not occur in the proper place and stress may not be alleviated over much of the area.

A properly executed sanitation cutting in stands in this recreation complex would involve removal of a large number and volume of trees. Because of the decadence and amount of dwarf mistletoe in many of the stands, restricting further spread of diseases would be difficult without removing most of the vegetation. In the case of red fir dwarf mistletoe, removing infected overstory trees and thinning the understory to promote rapid height growth would reduce the future impact of the disease. Lodgepole pines with moderate to severe infections of dwarf mistletoe would have to be removed because they would not satisfactorily respond to any release treatments. All infected overstory trees would have to be removed if lodgepole pines in the understory were desired as replacement trees.

Activities to reduce the levels of diseases would reduce stocking levels in parts of the area and increase residual tree vigor. There would still be dense aggregations of trees which would be of poor vigor. Overall, the amount of insect activity would be lessened as weakened trees are removed and many residual trees improve in vigor.

Following implementation of this alternative, future mortality and risk of hazard would be reduced. The residual stands would vary in appearance. Many of the stands would be understocked, with openings common. Residual trees may or may not respond in vigor or growth. Species composition may shift in some areas toward more white fir. Some dense aggregations would remain in a few areas. Future regeneration and subsequent growth may be limited on harsher sites, such as Camp Minkalo and parts of Silver Lake West. Removal of large numbers of trees on wetter sites at the Stockton Municipal Camp may result in a rising of the water table because of less transpiration. This may have an adverse effect on residual vegetation.

4. **VEGETATION MANAGEMENT.** The intensity of activity would vary depending on the influence of other objectives, such as recreation needs and visual quality, on the primary objective of promoting vegetation health and vigor. This could be the most aggressive of the alternatives and would have the greatest opportunity of achieving the primary objective.

To optimize stand health, a sanitation harvest would be implemented as in Alternative 2. This sanitation harvest would be directed at removing hazardous trees, trees with moderate to severe dwarf mistletoe infections, trees with

bole cankers of any origin, trees with evidence of decadence, and trees with defects, such as dead tops, trunk decay, and large basal scars.

In addition to a sanitation harvest, overstocked aggregations would be thinned. The objective would be to promote a multiple-layered, mixed species stand that would respond to release. Selection criteria should be based on achieving the desired stand structure and composition, and then on further reducing the presence of any pests or defects until the desired stocking level is achieved.

In much of the recreation complex, these dense aggregations will be small islands interspersed among sparsely stocked stands and openings created by the sanitation harvest. Regeneration of these areas will be necessary, but will be complicated by the presence of dwarf mistletoe in residual trees. Where trees with dwarf mistletoe are left in the stand or along the stand's edge, species available for regeneration will be limited. Only non-hosts should be planted in these areas.

Because of visual requirements tree removal may need to occur gradually in stages. In dwarf mistletoe-infested stands, natural regeneration of the host species should not be encouraged. Planting of non-hosts may be necessary. The need for multiple entries could result in increased tree damage, as well as higher costs, more disruption of recreational use, and increased risks to physical improvements.

This alternative will require a considerable period of time to achieve the desired result because of the number and distribution of overmature, diseased, and decadent trees and the need to replace them with younger, more thrifty individuals. Eventually, the stands would be comprised of smaller size classes of trees that are relatively healthy and pose little hazard to recreationists and property. Species composition may shift somewhat away from red fir because of the extent of dwarf mistletoe present, but it would still be the principal species in areas where it is at present because of its appropriateness for the site. Species, such as mountain hemlock, that do not presently grow on the site but do grow nearby may be planted, but this should be limited.

5. RELOCATE RECREATION DEVELOPMENTS. Because of the similarity of much of the vegetation and its condition around Silver Lake and topographic constraints, alternative locations with healthier vegetation are limited. Relocating facilities with high value improvements, such as the resort and summer cabins, to new areas could reduce future damage from tree failures. If such facilities were relocated, a greater range of vegetation management options would be available for these vacated lands. More aggressive actions could be taken to speed up the rehabilitation of sites and replace existing vegetation with healthier, more vigorous stands of trees. Other facilities in the area, such as the campgrounds, could then be relocated onto these rehabilitated sites, permitting vegetation management to occur on the original sites.

Management of Specific Pests

I. ANNOSUS ROOT DISEASE

a. Stump treatment. The stumps of all freshly cut conifers should be treated with borax (sodium tetraborate decahydrate) according to label

directions. Use of this pesticide will reduce the probability of new root disease centers becoming established.

b. Regeneration. In established root disease centers care should be taken in the selection of species for regeneration. Most hardwood species are immune to infection, however, none, except aspen in wet areas, are presently growing in the area and their introduction is not recommended. All identified centers involved true firs as host. It appears some host specificity exists for this fungus and regeneration with conifers other than true firs in these centers may be acceptable. Pines and western juniper are the reasonable alternatives. Lodgepole pine should not be planted in areas where its dwarf mistletoe is nearby. Western white pine is not recommended as a species to plant because of the presence and hazard from white pine blister rust.

c. Thinning. Living true firs in and on the margin of annosus root disease centers probably are or will be infected by the fungus. Because of the apparent low level of virulence of this fungus against true firs, it appears that actions can be taken that minimize the impact on individual trees. This is based on the little we know of the biology of the fungus, and has not been documented through adequate research. By reducing the competition and promoting the growth of residual trees through thinning, sufficient root growth may occur to replenish the number of roots lost to the fungus. However, once the main structural roots are decayed the probability of windthrow will increase.

II. DWARF MISTLETOE

a. Regeneration. When planting areas within or bordering dwarf mistletoe-infested stands, the species of planting stock should be different from that of the bordering stands unless those sources of infection are to be removed within 10 years. Western white pine is not a satisfactory replacement species because of the likelihood of infection by white pine blister rust.

b. Suppression. The most direct method of controlling dwarf mistletoe is by removing all host trees in an area. In situations where continuous tree cover is desired, such as recreation areas, this may not be possible. Other alternatives are available that can reduce the impact of this disease.

1. Gradual conversion. The first step would be to open up the stand by removing heavily infected and non-desirable trees. This would be followed by planting and encouraging the regeneration and growth of non-host trees. As infection levels increased in residual trees, they would be removed through periodic sanitations. This would aid in releasing the understory and reducing the competition with any non-host overstory. The time involved to complete this program would vary considerably depending on the number of non-host species in the stand and the amount of regeneration and its rate of growth. This may be successful in the area around the Oyster Creek roadside rest where both lodgepole and red fir dwarf mistletoes are present. A component of Jeffrey pine, white fir, and aspen is present and regeneration by these species may be encouraged through slow removal of dwarf mistletoe infected trees and planting.

2. Broom pruning. In certain situations where infected individual trees are considered of high value and need to be retained, pruning of witches'

brooms may be advantageous. Although broom pruning will not eliminate the mistletoe, the removal of these large brooms, which use a large amount of the food and nutrients in a tree, can reduce stress on the tree, thereby prolonging its life until non-host replacement trees are established. At Silver Lake this may be effective with lodgepole pine dwarf mistletoe because of the number of brooms observed. Specifically, it may be effective at Silver Lake West Campground along Highway 88 where lodgepole pine is an effective screen between the campground and the highway. It would probably not be as effective with red fir because of the limited formation of witches' brooms in this species.

3. **Release.** Increasing the rate of height growth of red fir in an area without an overstory infection source can reduce the effects of dwarf mistletoe in a stand. Because of the limited vertical spread of red fir dwarf mistletoe in a crown, trees growing a foot or more a year in height can outgrow dwarf mistletoe and reduce the proportional amount of the crown infected by dwarf mistletoe. Any overstory source of infection must be removed to eliminate new infections in the upper crown. In some cases, the residual stand must be thinned to attain adequate height growth. Although severely infected trees should be selected against during thinning, the more important criteria are an adequate live crown ratio and the ability to respond to release. This approach may be effective in areas where sufficient advance regeneration will be present following overstory removal. Such an area may be around parts of Kit Carson Resort.

c. **Eradication.** In areas where the extent and intensity of dwarf mistletoe is limited, an eradication effort may be successful if done with considerable care and aggressiveness. This type of program would require removal of trees too heavily infected to undergo pruning or with infections in the upper 50 percent of the crown. Trees with infections in the lower 50 percent of the live crown could be pruned of all branches at and below the highest infected branches plus two whorls above the highest visible infections. If the distance from the infection to the bole is less than 4 inches, then it is likely the mistletoe has entered the bole and pruning would not be effective. An effective buffer strip would be necessary between the treated stand and any surrounding infested stands to prevent reintroduction of the mistletoe. A retreatment of the stand would be required at 3 to 5 years after treatment to remove any infections that were missed or were latent during the initial treatment. The limited infections of lodgepole pine dwarf mistletoe at Stockton Municipal Camp, Plasses Summer Home Tract, and Silver Lake West Campground could be treated in this manner.

III. FIR ENGRAVER

a. **Disease control.** The treatments listed to prevent or reduce the impact of red fir dwarf mistletoe and annosus root disease will generally reduce susceptibility of trees to the fir engraver.

b. **Thinning/sanitation.** Fir stands that are maintained at or below normal stocking by thinning will generally have less mortality and top killing by the fir engraver than more densely stocked stands. In areas where white fir is already a significant component of the stand, or is likely to become more prominent because of control treatments for red fir dwarf mistletoe, the use of white fir stocking guidelines may provide better results.

Suppressed understory trees and decadent overstory trees are quite susceptible to fir engraver attack, but they can also increase the susceptibility of nearby trees that appear more vigorous. As long as they remain alive, the suppressed and decadent trees will compete with their neighbors for water, nutrients, and light, which can lower the vigor of the entire aggregation. When suppressed or decadent trees come under attack by the fir engraver, the pheromones released by the attacking beetles may, under some circumstances, cause a small group of trees to be killed. The selective removal of suppressed and decadent fir trees can assist in maintaining long-term vegetative cover.

c. **Control of species composition.** Although it is generally true that mixed species stands are more resistant to pests, the microsite should be taken into account. Thin soil in some parts of Camp Minkalo, Plasses summer home tract, and the western edge of Silver Lake Campground West is prone to drought. True firs will germinate on these sites and survive to the size of large saplings or small poles, particularly if they are in the shade of overstory trees. The firs will become more susceptible to the fir engraver with the passage of time and considerable numbers can be attacked during a dry year. A continuous cover of vegetation would be easier to achieve in these areas if the total basal area was kept at a low level and if true firs were restricted to the pockets of deeper soil.

IV. MOUNTAIN PINE BEETLE

a. **Dwarf mistletoe control.** Lodgepole pine severely infected with dwarf mistletoe is more susceptible to mountain pine beetle. When one of these trees is attacked, the pheromone released can draw in enough beetles to kill additional trees within about 20 feet. Removal of severely infected trees before they are attacked can reduce the potential threat to other uninfected or lightly infected lodgepole pines nearby.

b. **Thinning.** In California, lodgepole pine can attain several feet in diameter and live for several centuries if it is free to grow. Thinning older stands will probably not result in much release, but should aid in prolonging the lives of the residual trees. Densely stocked stands may need to be treated by several light thinnings, separated by enough time for crowns and root systems to respond in order to avoid windthrow or snow breakage.

c. **Cultivate replacement aggregations.** There is little natural thinning in young lodgepole pine stands because few insects infest trees under a diameter of 4 inches. By the time the trees reach that point in a natural stand, they are already stagnated. Thinning treatments in older stands are more expensive and produce fewer results. While thinning an aggregation of seedlings or small saplings will have no effect on the current rate of mountain pine beetle infestation, it can prevent some future losses and provide a healthier replacement stand in less time.

d. **Insecticide treatment.** If individual high value lodgepole pines are undergoing a temporary, reversible stress, such as drought, they can be protected from mountain pine beetle attack for a period of up to one year. Several carbaryl formulations are registered to be applied to the boles of pines for this purpose.

SILVER LAKE RECREATIONAL AREA

DISEASE AND INSECT LOCATIONS

KEY TO MAPS - 1986

SILVER LAKE EAST CAMPGROUND

1. Hazardous white fir (WF), 54" dbh, basal wound with lean, 4-1/2" sound wood, Indian paint fungus (ET) conks on bole, callusing seam originating at wound, hazard rating (HR) = 6 (3+2+1) (impact+target+lean)

2. Basalt outcrop, red fir (RF) generally in poor condition with dwarf mistletoe (DM), thin aggregate to release western white pine (WWP) and WF

3. Old windthrown RF with root decay and callus on roots, decay from Armillaria, possibly Fomes annosus (FA) decay

4. Intermediate RF, 17" dbh, 3 DM bole cankers - 2 open in lower bole, adjacent to rest room, heavy DM, possible hazard

5. Hazardous RF, 40" dbh, large bole wound at 10', 7" sound wood, HR = 5 (2+3)

6. Hazardous RF, 29" dbh, broken top with volunteer top, resin streaming on volunteer, decay in top, HR = 4 (2+2)

7. Hazardous RF, large open bole canker at 6', decay in open face, fork at 20', HR = 4 (2+2)

8. Hollow RF stumps with FA conks, no above ground damage apparent

9. RF stumps with FA conks, no above ground damage apparent, no nearby regeneration

10. Hazardous WF, 36" dbh, basal wound on windward side, 2" sound wood above wound, ET conks on bole, callused seam, HR = 4 (3+1)

11. Large hazardous RF with several year old dead top, bark falling off, decay, HR = 3 (2+1)

12. RF stump with FA conk, no above ground damage apparent

13. RF stump with FA conks, adjacent to dead RF

14. Hazardous RF, 36" dbh, dead top broken out, ET conks, basal wound and butt hollow, 2-3/4" sound wood, HR = 4 (3+1)

15. RF stump with FA conks, no above ground damage apparent

16. 2 RF stumps with FA conks, no above ground damage apparent

17. 2 RF stumps with FA conks, no above ground damage apparent, no regeneration

18. 4 RF stumps, 1 with FA conks, large dying RF nearby

19. RF stump with FA conk, no above ground damage apparent

20. Hazardous RF, 25" dbh, open bole canker at 20', 2 bole cankers at 40', decay below lowest canker, HR = 3-4 (2+1-2)

21. Hazardous RF, 46" dbh, basal wound on side opposite slight lean, 12" solid wood perpendicular to wound, advanced decay in wound face, HR = 4 (1+2+1)

22. Hazardous RF, open bole canker at 8', HR = 3 (1+2)

23. Hazardous WF, 26" dbh, 4" sound wood, bleeding frost cracks, ET conks, HR = 4 (1+2+1)
    Hazardous RF, 46" dbh, 7-1/2" sound wood, basal wound with decay, ET conks, HR = 3 (1+2)

24. 5 RF stumps with FA conks, 1 windthrown RF, large opening with no regeneration

25. Hazardous WF, 46" dbh, 7-1/2" sound wood, ET conks, stem deformity at 6', stem above deformity leans toward camp site

26. RF stump with FA conk, no above ground damage apparent

27. Hazardous RF, 40" dbh, basal wound, 3-1/2" sound wood perpendicular to wound, slight lean away from wound toward site 52, HR = 5 (2+2+1)
    Hazardous RF, large basal wound, decay extending into roots, slight lean in direction of wound toward site 52, HR = 5 (2+2+1)

28. Hazardous RF, 33" dbh, basal wound extending to 12', 6-1/2" sound wood perpendicular to wound, slight lean away from wound, HR = 4 (2+1+1)

29. RF stump with FA conk, no above ground damage apparent

30. RF stump with FA conk, no above ground damage apparent, small opening

31. RF stump with FA conk, no above ground damage apparent

SILVER LAKE WEST CAMPGROUND

32. Hazardous WF, , broken top and decay, large dead limbs, broken limbs around base, limited target, HR = 4 (2+2)

33. Dying WF, 25" dbh, dead top, lean, red and white sawdust at base, Ambrosia beetles in butt, roundheaded fir borer in butt, probably fir engraver (SV) higher in bole, Armillaria mycelial fans at root collar

34. Hazardous lodgepole pine (LP), 28" dbh, basal wound and decay, 5-1/2" sound wood perpendicular to wound, lean in direction of wound over campsite, HR = 5 (2+2+1)

35. Hazardous WF, 56" dbh, lean, 3-1/2" sound wood on back side of lean, top broken out, leaning over site 81, HR = 5 (2+2+1)

36. Hazardous RF, basal wound on southwest side, decay and hollow extending up bole, leans away from wound, HR = 4 (2+1+1)

37. Hazardous RF, 43" dbh, old decaying top, 2 volunteer tops, open seam in bole, hole in base, 6" sound wood, HR = 5 (2+3)

38. RF stump with FA conks, no above ground damage apparent

39. RF stump with FA conks, no above ground damage apparent

40. Hazardous RF, holes in base and decay, dead decayed top, slight lean away from campground, HR = 3 (2+1)

41. Dense thicket of seedling and sapling RF with no overstory, thin to release best individuals

42. RF stump with FA conks, no above ground damage apparent, small opening

43. Hazardous RF, 42" dbh, basal hole and decay, 6-1/4" sound wood, HR = 3 (2+1)

44. Hazardous RF, large forked tops, 1 at right angle and leaning, large basal wound with decay, leaning over site 73, HR = 6 (3+2+1)

45. Hazardous WF, 31" dbh, basal hole and butt hollow, lean away from hole, HR = 4 (2+1+1)

KIT CARSON RESORT

1. RF stump with FA conk, no above ground damage apparent

2. RF stump with FA conk in a small opening, no above ground damage apparent

3. Hazardous WF with basal wound and decay, hollow extends up bole, target is road, HR = 3 (2+1)

4. Two large RF heavily infected by DM, poor live crown ratios, very slow diameter growth past 30 years. RF, 31" dbh, on west side closer to entrance road with hole in base and decay in butt and roots, 1-1/2" sound wood at breast height above wound, target is road, HR = 4 (3+1)

5. RF stump, adjacent dead WF sapling, FA in roots of sapling

6. RF with basal hole, decayed staubs from base on opposite sides, 3-1/2" sound wood above wound at 22' diameter, target is cabin, HR = 4 (2+2)

7. RF with poor crown, resin streaming in top, woodpecker work at base, roundheaded borer activity at base, tree dying

8. RF stump with FA conks, no above ground damage apparent

9. RF with 2 basal wounds with decay on opposite sides, 28" dbh, slight lean into wound, 4-1/2" sound wood, HR = 6 (3+3)

10. RF with declining crown, resin streaming

11. WF stump with FA conks, no above ground damage apparent

12. Large WF at end of road with large basal wound and decay, opposite side sound, slight lean perpendicular to wound over parking area, HR = 3 (2+1)

13. Large RF just behind lodge, 45" dbh, butt sound, multiple tops - 1 dead, other 2 relatively small (6-8 " at base) but growing with some swelling at V-crotch, HR = 4 (1+3)

14. WF seedlings next to RF stump, 1 dead and 1 dying, FA conks at base of dead seedling

EAST SILVER LAKE SUMMER HOME TRACT

1. RF with basal wound and decay on side facing cabin, slight lean toward cabin

2. RF with green crown, boring dust and Polyporus volvatus conks in butt, tree dead

3. RF with large basal wound and rot column, next to cabin

4. Windthrown RF along road, roots decayed, FA conks on roots

5. RF with huge fire scar, hollow and decay (cat face) on side facing lake, tree leans into wound, target is utility shed or corner of house

6. RF with old broken out top, boring dust, tree dying

7. RF with broken out top, cambium dead below top breakage, bird nesting cavities in dead bole portion

8. RF with broken out top and new volunteers, broken top decayed, bird nesting cavities in bole below volunteer, limited target potential

9. RF stump with rhizomorphs and old mushrooms of Armillaria and conks of FA, no above ground damage apparent

10. RF along road with hole in butt and open seam at 10 feet, 7-1/2" sound wood at 43" diameter on side opposite wound

11. WF with old broken top, decay and volunteers, butt hollow, FA conks in hollow, no permanent target

12. RF with green crown, woodpecker work in base, roundhead emergence holes, tree dying, strip kills

13. RF with recently killed top, target is parked vehicles

14. Jeffrey pine (JP) along road with old dead top, large branches at top and along bole could fail, potential target is cabin 47

15. 2 WF with basal wounds and decay, slight lean away from cabin 52

16. Large WF dying from top down to mid-bole, limited remaining life

17. WF with basal wound extending to 10 feet, decay, butt out of round and leans into wound toward cabin 89

18. Group of WF and RF dead and dying, rocky site, overstocked, parking and driving pressure in immediate vicinity

19. WF dying from top down

20. Group of dead and dying RF and WF, probably fir engraver, indicative of effects of overstocking

CAMP SILVERADO

1. Group of dead RF of all sizes, FA conk in stump, overstocked, DM in RF

2. RF stump with FA conks, recent dead standing RF

3. Hazardous RF, 31" dbh, forked top at 30 feet, tight V-shaped fork, resin at fork, HR = 5 (2+3)

4. Hazardous RF, 53" dbh, basal cavity on uphill side, leaning toward canteen, HR = 5 (2+3)

5. Hazardous RF, basal wound perpendicular to lean with hollow extending into tree, lean toward hospital, 2" sound wood above hollow at 39" diameter, bole canker at 12 feet, HR = 6 (2+3+1)

6. Overmature RF with flattened tops, large dead witches brooms hanging on boles, some DM bole cankers, branch flagging, bole breakage common, understory RF infected by DM

CAMP MINKALO

1. Aggregation of sapling and pole size RF dead and dying from fir engraver (SV), overstocked, suppressed

PLASSES SUMMER HOME TRACT

1. LP with basal wounds, 30" dbh, decay on road side, sunken seam on side leaning toward road, 3" sound wood on leaning side

2. RF next to building with fresh top kill

3. Group of RF, 2 with green crowns but dead, remaining do not look healthy with lots of pitch

4. RF with green crown, dead at base

5. Dead RF coming through deck, RF next to deck with green crown but infested by SV

6. RF next to shed with heavy pitch streaming, lifespan limited

7. RF with pitch streaming, patch kills of cambium, lifespan limited

8. LP with large basal wound and decay, tree leaning into wound toward generator shack

9. LP with basal wound, decay, lean away from target

10. LP with red pitch tubes of mountain pine beetle (DP) in lower 12 feet of bole, some beetles active in cambium, some cambium dead, lifespan limited

11. 2 RF joined at base, 1 with red crown, other with white boring dust at base, dying limbs in crown, lifespan limited

12. RF with green crown, white boring dust at base, orange paint, lifespan limited

13. 2 RF, 1 with red crown, 1 with green crown, both dead from SV

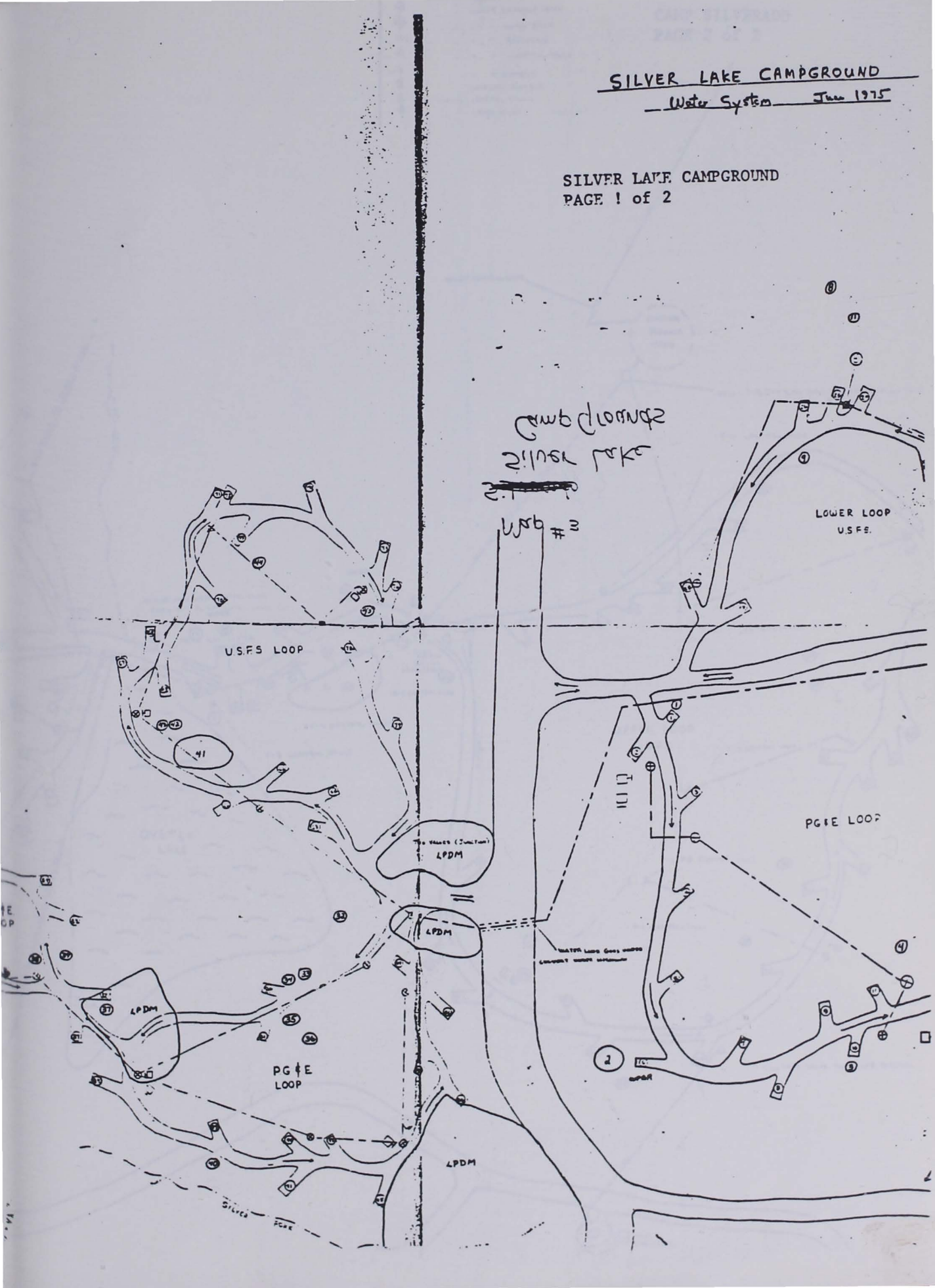
STOCKTON MUNICIPAL FAMILY CAMP

1. LP with western gall rust cankers on 3 sides at 8 feet, crack across canker face, large patch of exposed wood, leaning toward H1

2. Area of RF with large dead limbs, broken tops, volunteer tops, forks, DM, numerous cabins as targets, pitch streaming on smaller RF

SILVER LAKE CAMPGROUND
Water System Jan 1975

SILVER LAKE CAMPGROUND
PAGE 1 of 2



CAMP SILVERADO
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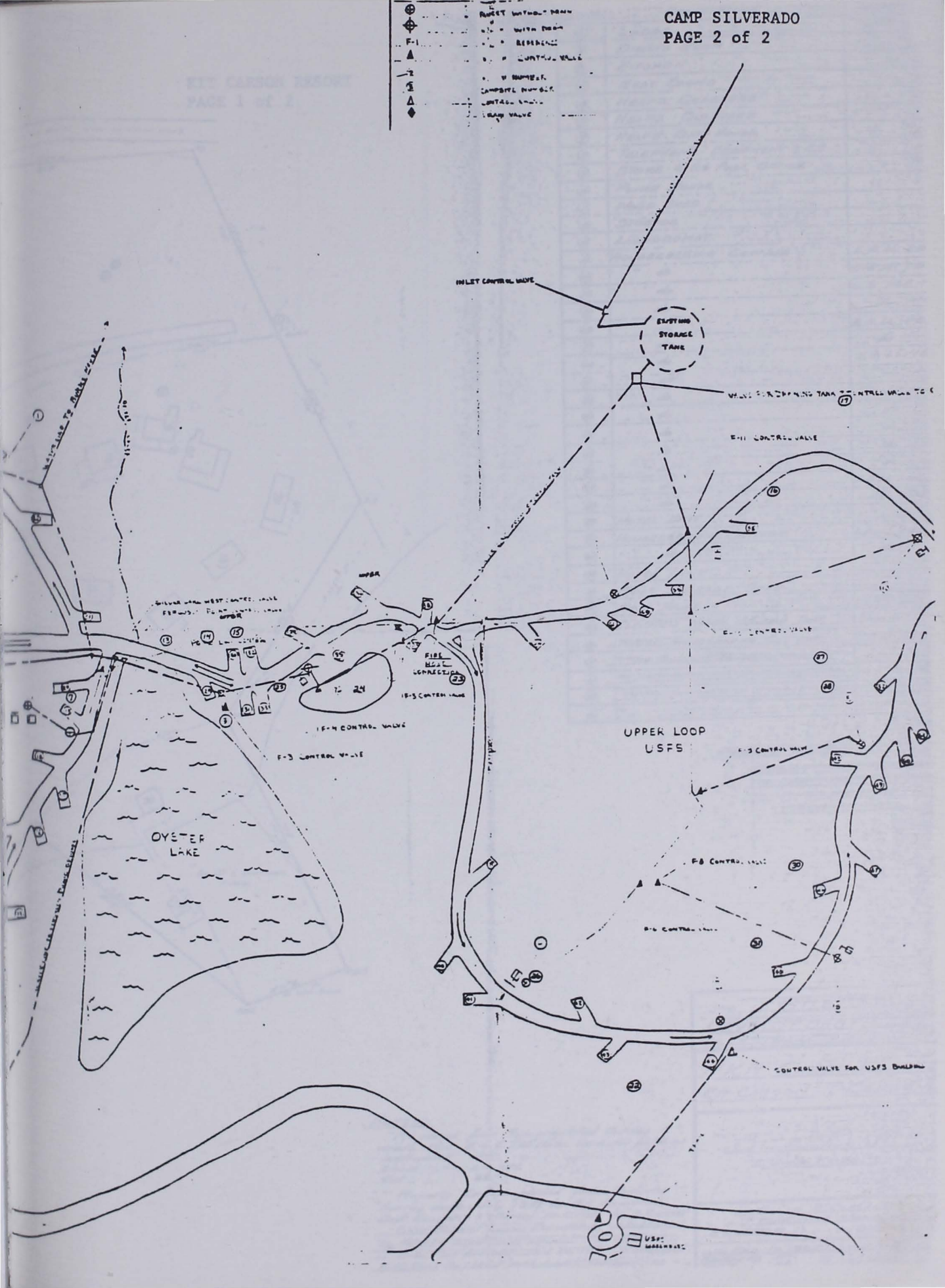


KIT CARSON RESORT
PAGE 1 of 2

Bldg. No.	Description	Remarks
1	Lodge	
2	Dining Room	
3	Kitchen	
4	Rest Rooms	
5	Helps Quarters	
6	Helps Quarters	
7	Helps Bath House	
8	Telephone Equipment & RR	
9	Store & U.S. Post Office	
10	Power House	
11	Wood Shed	
12	Storage	
13	Laundromat	
14	Housekeeping Cottage	2 B. 1 L. 2 B
15	do	2 B. 1 L. 2 B
16	do	2 B, 1 BR
17	do	do
18	do	2 B. 1 L. 2 B
19	do	do
20	do	2 B, 1 L, 1 B
21	do	do
22	do	do
23	do	do
24	do	do
25	do	do
26	do	do
27	do	2 B, 1 L, 1 BR
28	do	2 B, 1 L, 2 BR
29	Hotel Unit	
30	Housekeeping Cottage	2 B, 1 L, 2 BR
31	do	do
32	Hotel Unit	
33	Boat Storage Shed	
34	Boat House & Pier	
35	Elevated Water Storage Tank	5,000 Gal.
36	Winter Housekeeping Cottage	2 B, 1 L, 2 BR
37	Site for Future Additional Cottage	
38		
39		
40		

Possible Area
Resort
Island
Bed

Notes:
Picked from Topographical Survey made by S. & C. 7/16 Note Bench Mk. 37.61
Instrument No.
Chain 0.2 AE
Rod CE

Property Corners plotted from Compass Survey made July 1947 by G.I. Rowland, Dist. Ranger & Survey 1a C1068 by E. Culbert Gold Point Land Boundaries established by Forest Supervisor's Office May 6, 1907. Site Plan revised Jan 24, 1958 to include Location of proposed additional cottages as -

SITE DEVELOPMENT PLAN
Nov 12 1957

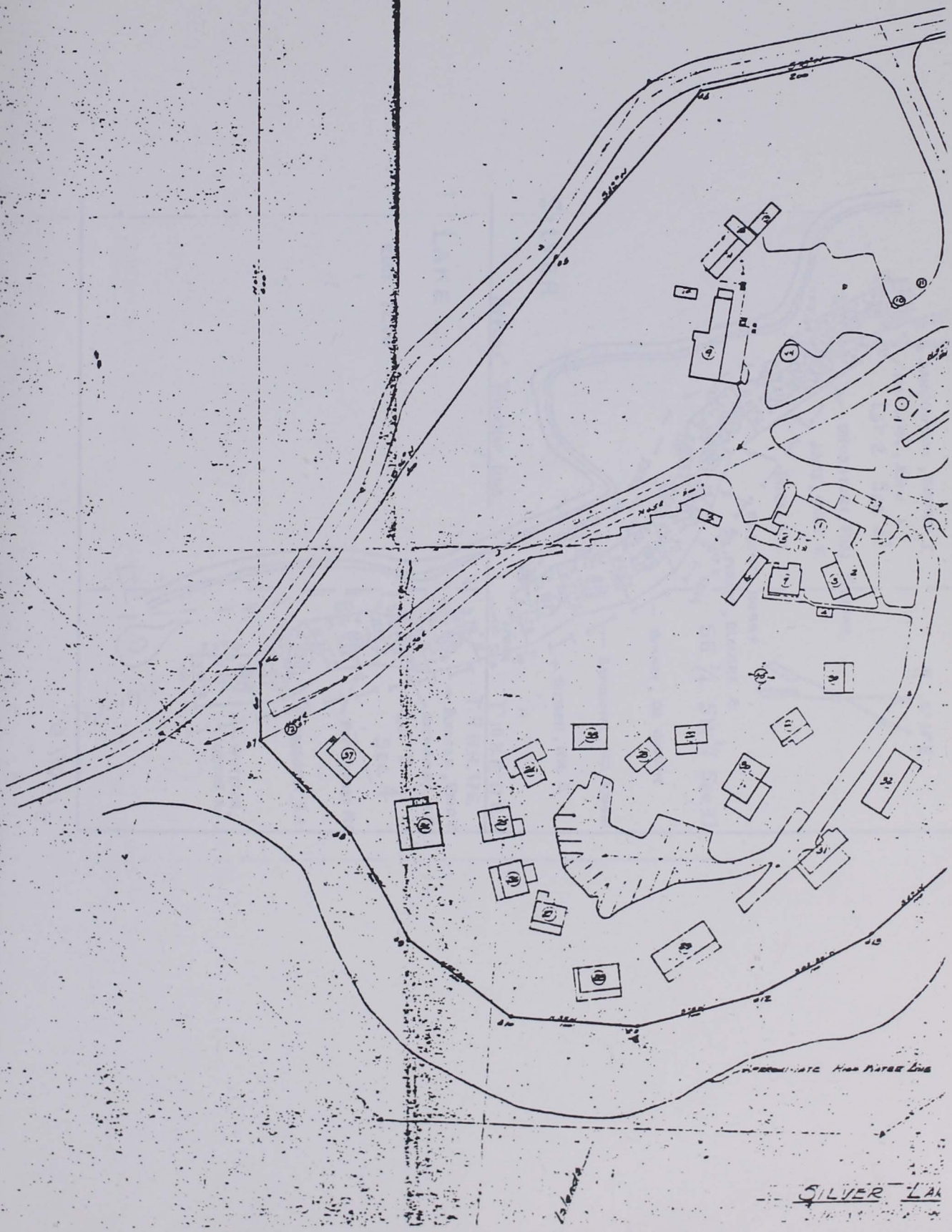
KIT CARSON LODGE
KIT CARSON - CALIFORNIA

SITE PLAN
Scale 1" = 50'

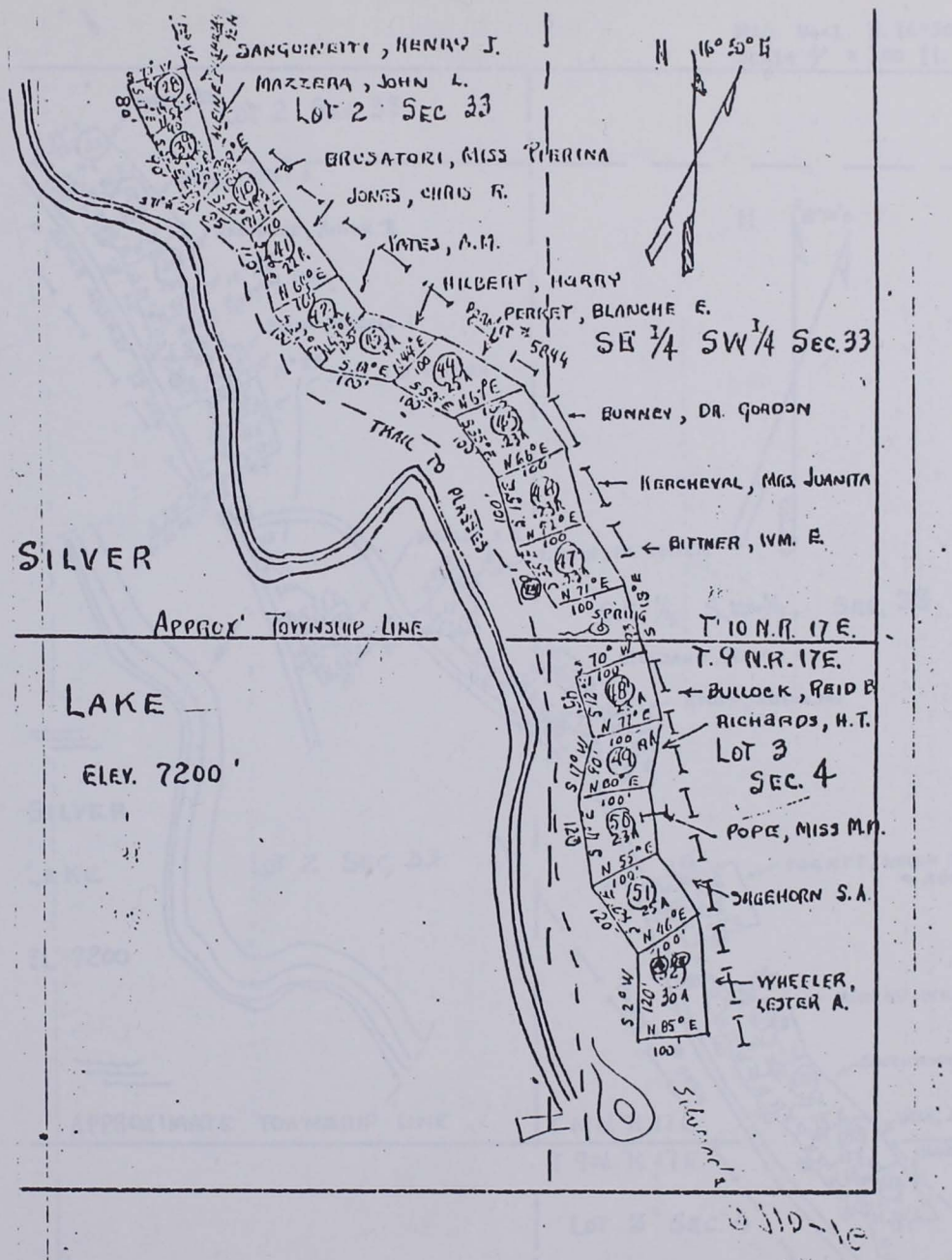
ELLIS E. ECKLAND
CONSULTING ENGINEER
41 N. HUNTER ST. STOCKTON, CALIF.

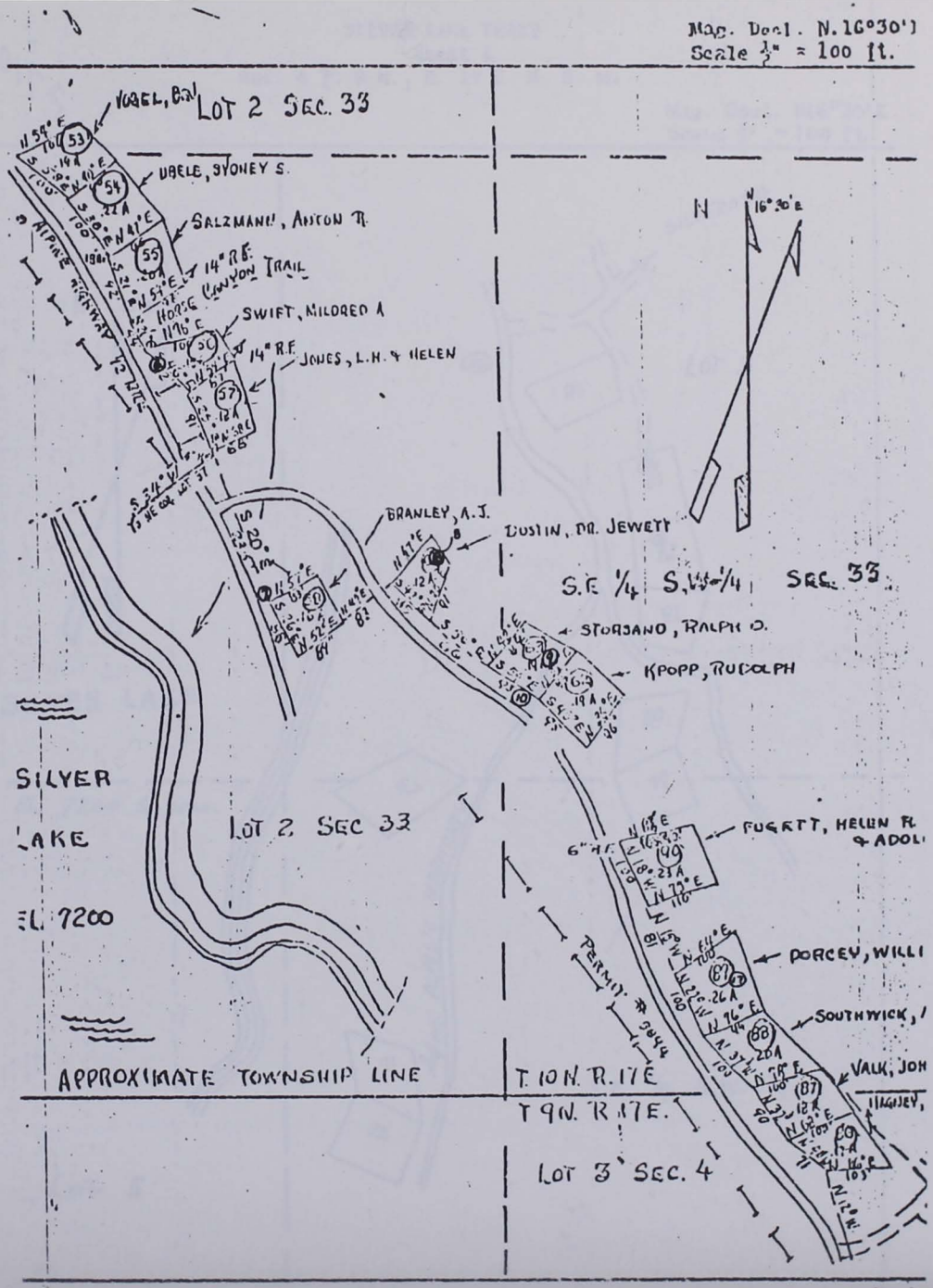
Date Oct 10, 1957
Checked by
Sheet No. 1 of 2
No. 206

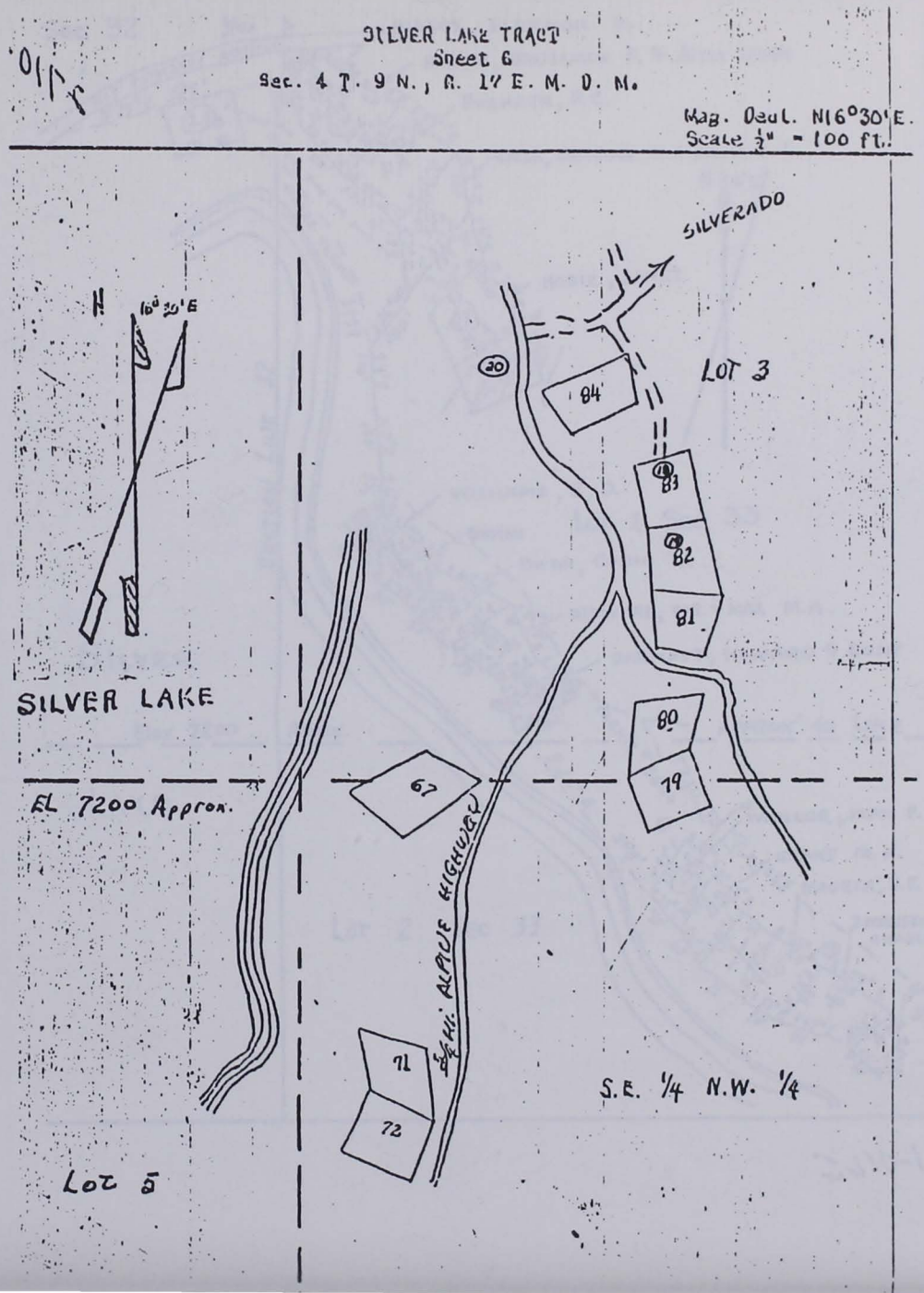
KIT CARSON RESORT
PAGE 2 of 2



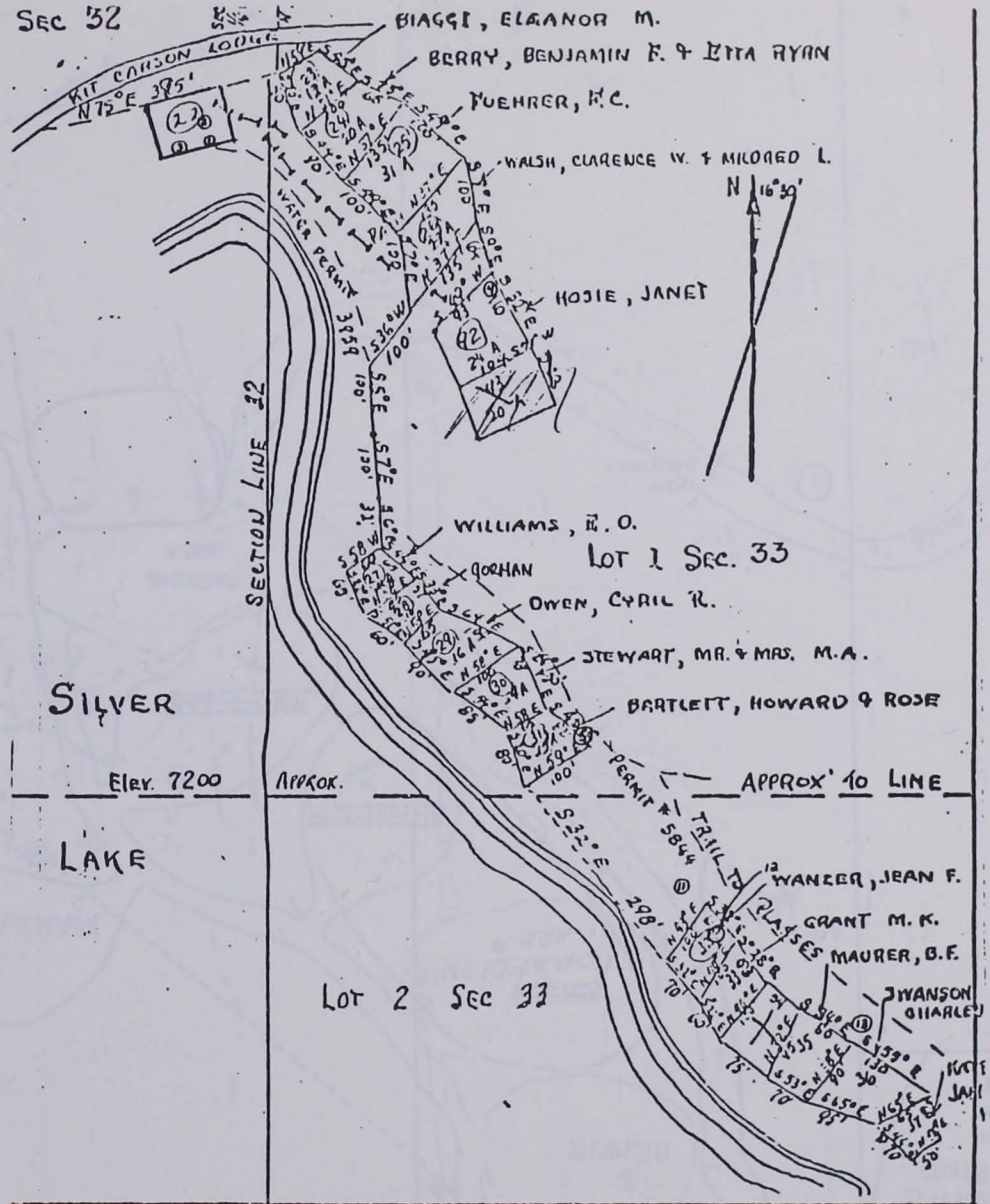
SILVER LAKE SUMMER HOME TRACT
PAGE 1 of 4

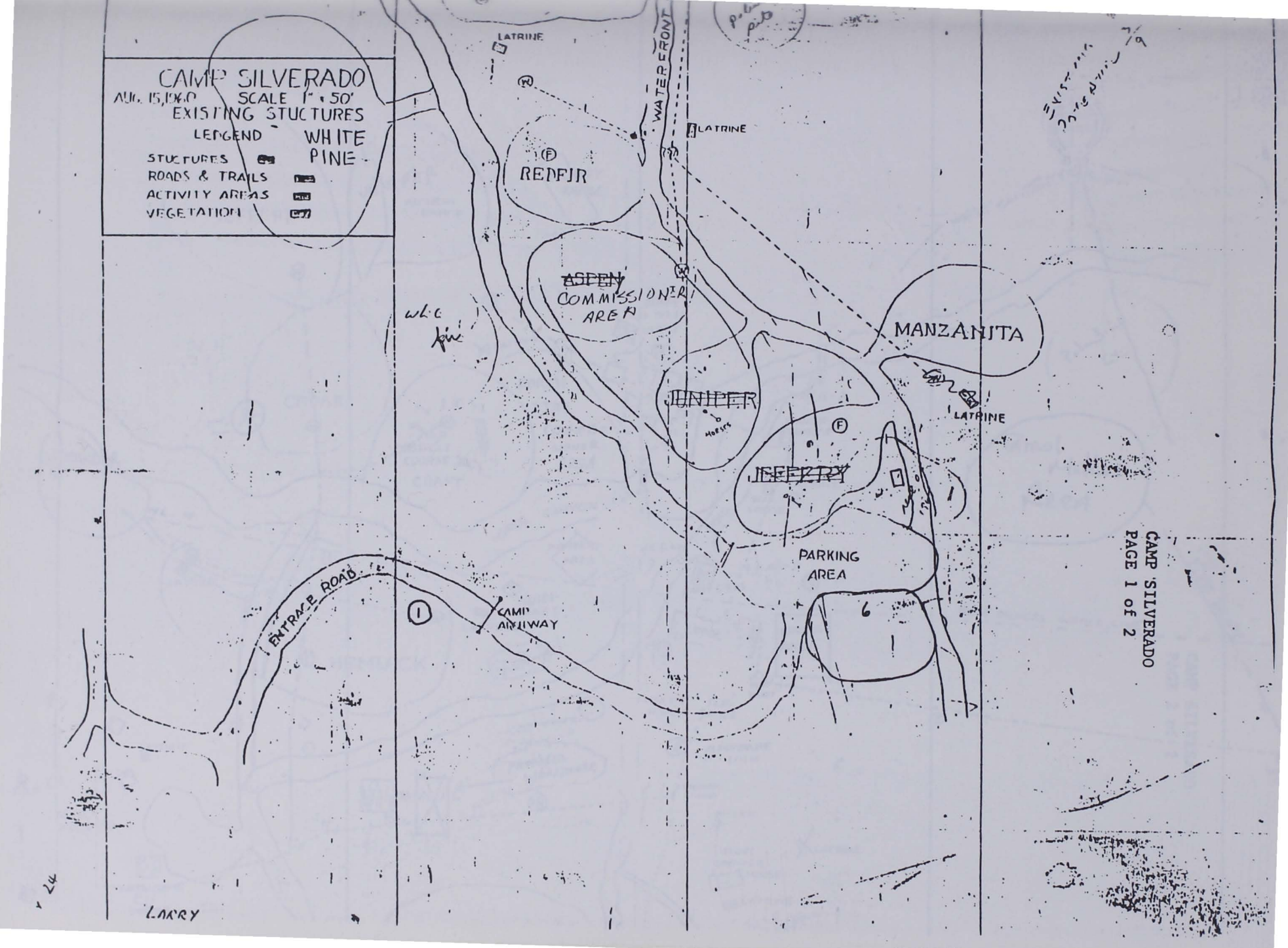


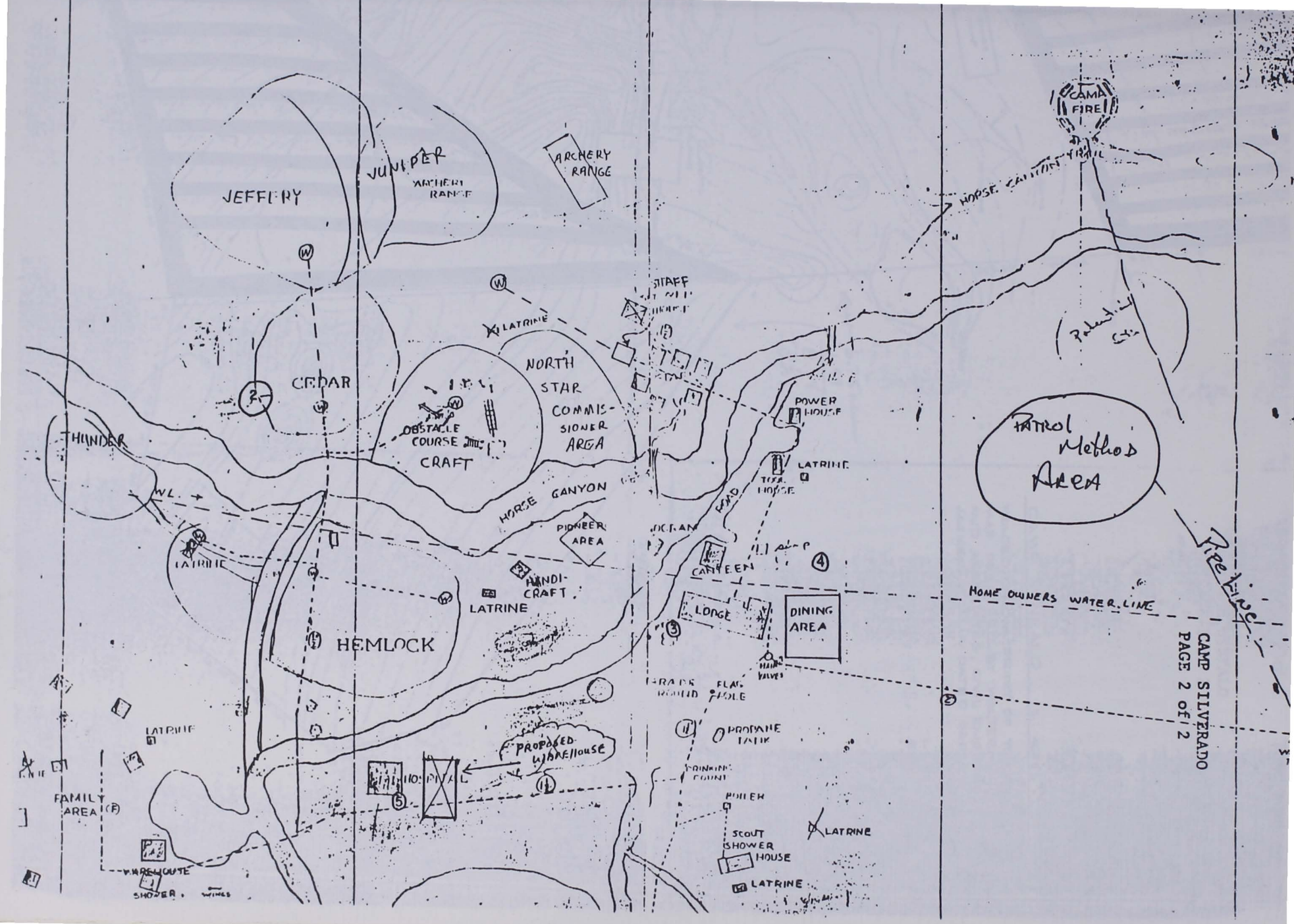

Mag. Decl. N. 16°30'
Scale 1" = 100 ft.
LOT 2 SEC. 33
VOGEL, BAY
UBELE, SYDNEY S.
SALZMANN, ANTON R.
14" R.F.
CANYON TRAIL
SWIFT, MILDRED A
14" R.F.
JONES, L.H. & HELEN
ALPINE HIGHWAY
BRANLEY, A.J.
DUSTIN, DR. JEWETT
S.E. 1/4 S.W. 1/4 SEC. 33
STORJANO, RALPH O.
KPOPP, RUDOLPH
SILVER
LAKE
EL. 7200
LOT 2 SEC 33
FUGETT, HELEN R. & ADOL
PORCEY, WILLI
SOUTHWICK,
VALK, JOH
PERMIT # 3944
APPROXIMATE TOWNSHIP LINE
T. 10 N. R. 17 E.
T 9N. R 17E.
LOT 3 SEC. 4


SILVER LAKE TRACT
Sheet 6
Sec. 4 T. 9 N., R. 14 E. M. D. M.
Mag. Decl. N16°30'E.
Scale ½" = 100 ft.
16° 30' E
SILVERADO
LOT 3
84
83
82
81
80
79
67
SILVER LAKE
EL 7200 Approx.
HWY ALPINE HIGHWAY
71
72
S.E. ¼ N.W. ¼
Lot 5

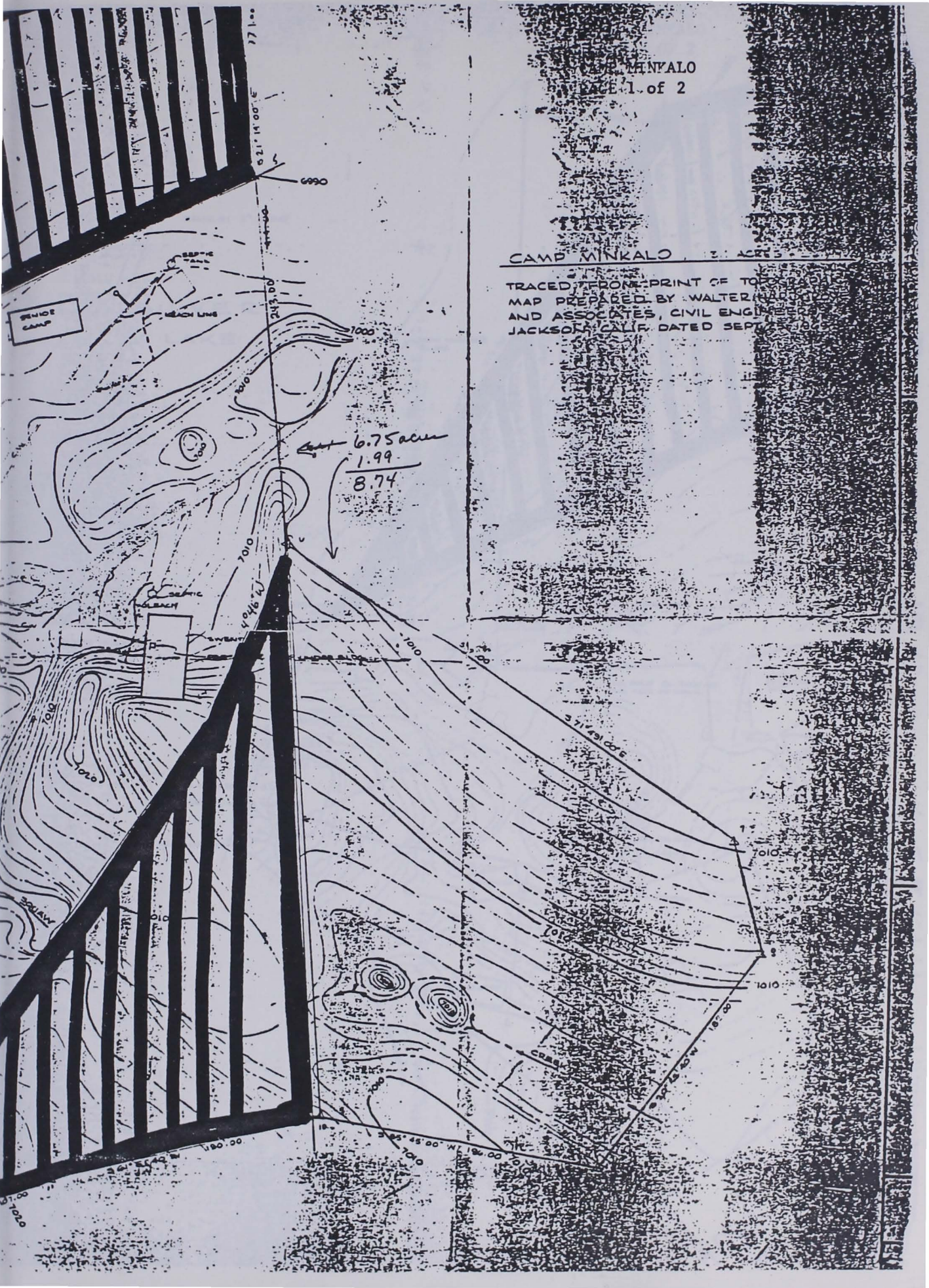
SILVER LAKE SUMMER HOME TRACT
PAGE 4 of 4

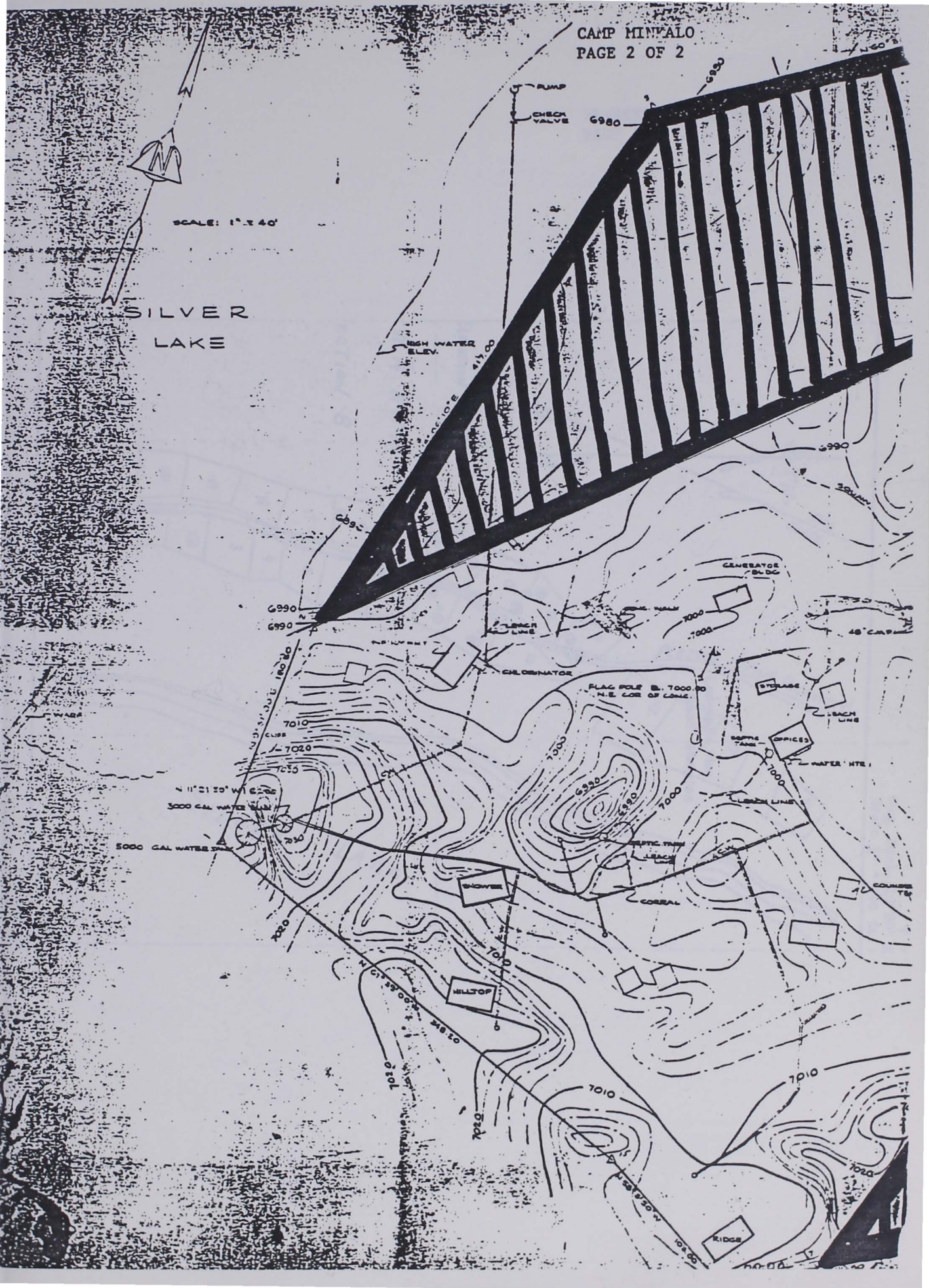



CAMP SILVERADO
AUG. 15, 1960 SCALE 1" = 50'
EXISTING STUCTURES
LEGEND
STUCTURES
ROADS & TRAILS
ACTIVITY AREAS
VEGETATION
WHITE PINE
LATRINE
WATERFRONT
LATRINE
REDFIR
ASPEN
COMMISSIONER AREA
MANZANITA
JUNIPER
LATRINE
JEEPERY
PARKING AREA
ENTRACE ROAD
CAMP AIRLIWAY
LARRY
CAMP SILVERADO
PAGE 1 of 2

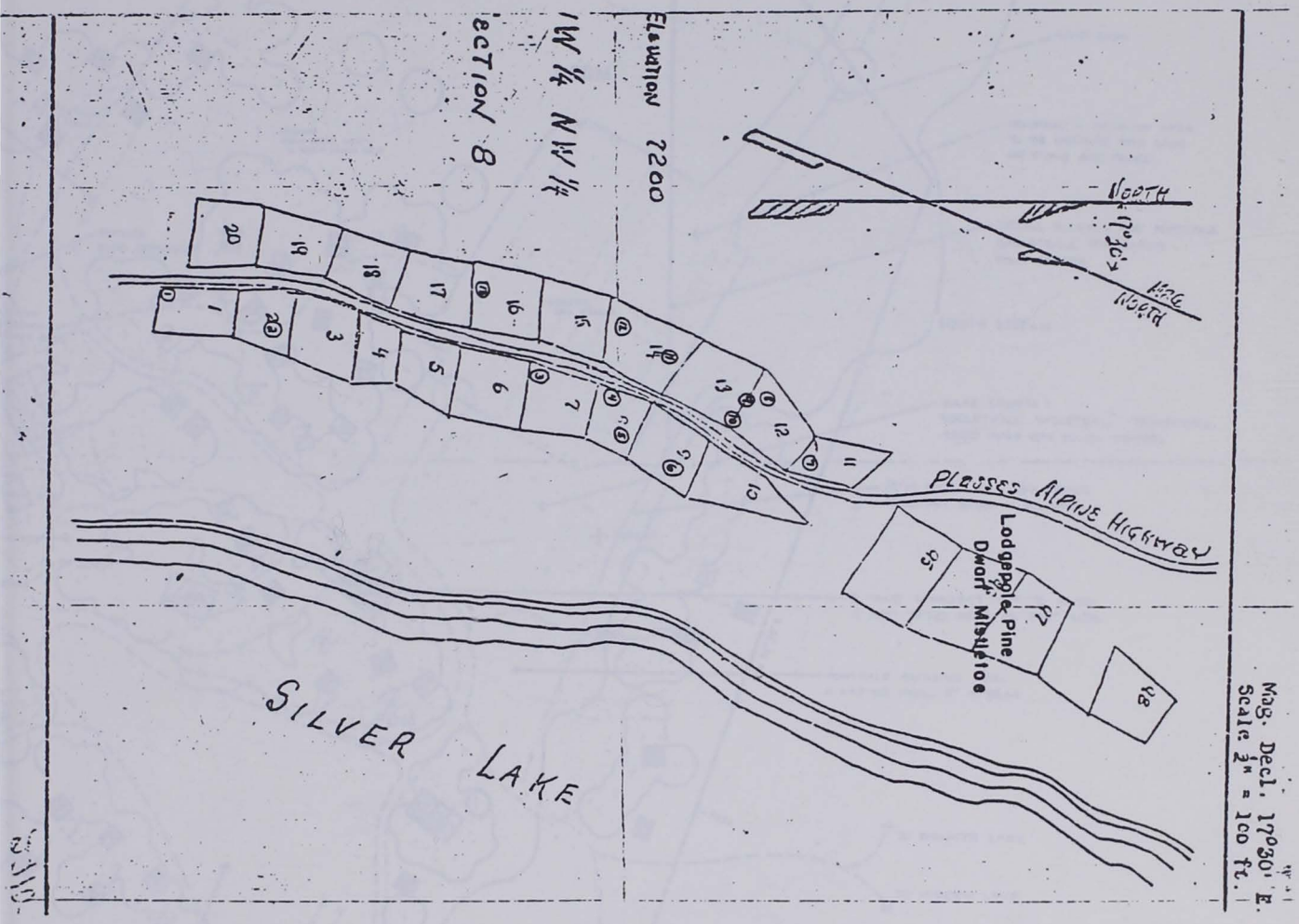


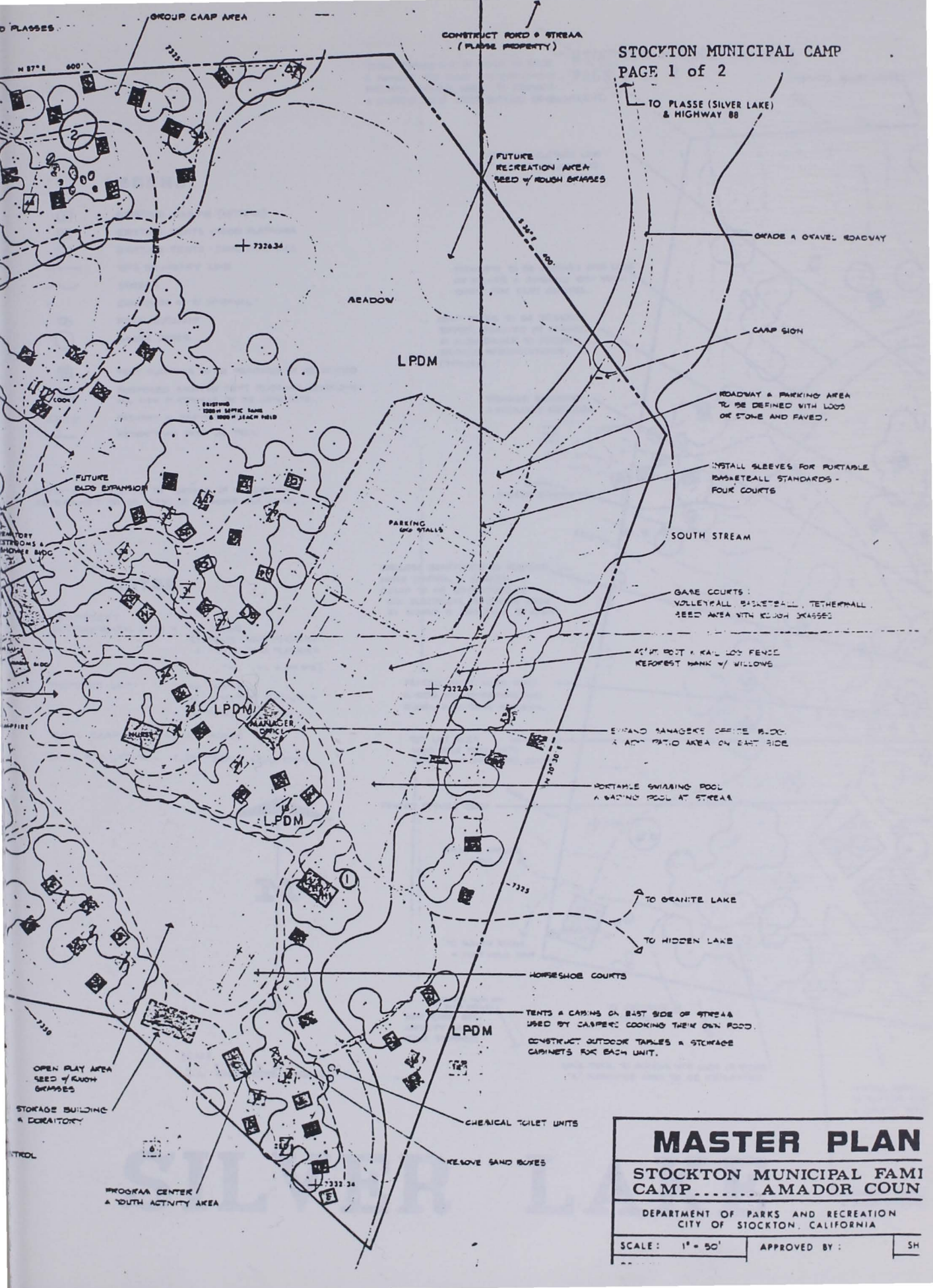
CAMP SILVERADO
PAGE 2 of 2


CAMP MINKALO
TRACED FROM PRINT OF TOPO MAP
AND ASSOCIATES, CIVIL ENGI
JACKSON, CALIF. DATED SEPT
SEPTIC TANK
SERVICE CAMP
BEACH LINE
1000
1010
6.75 acres
1.99
8.74
SEPTIC TANK
LEACH
UNDER BLDG
1020
CREEK
1010
1010
1010
1020

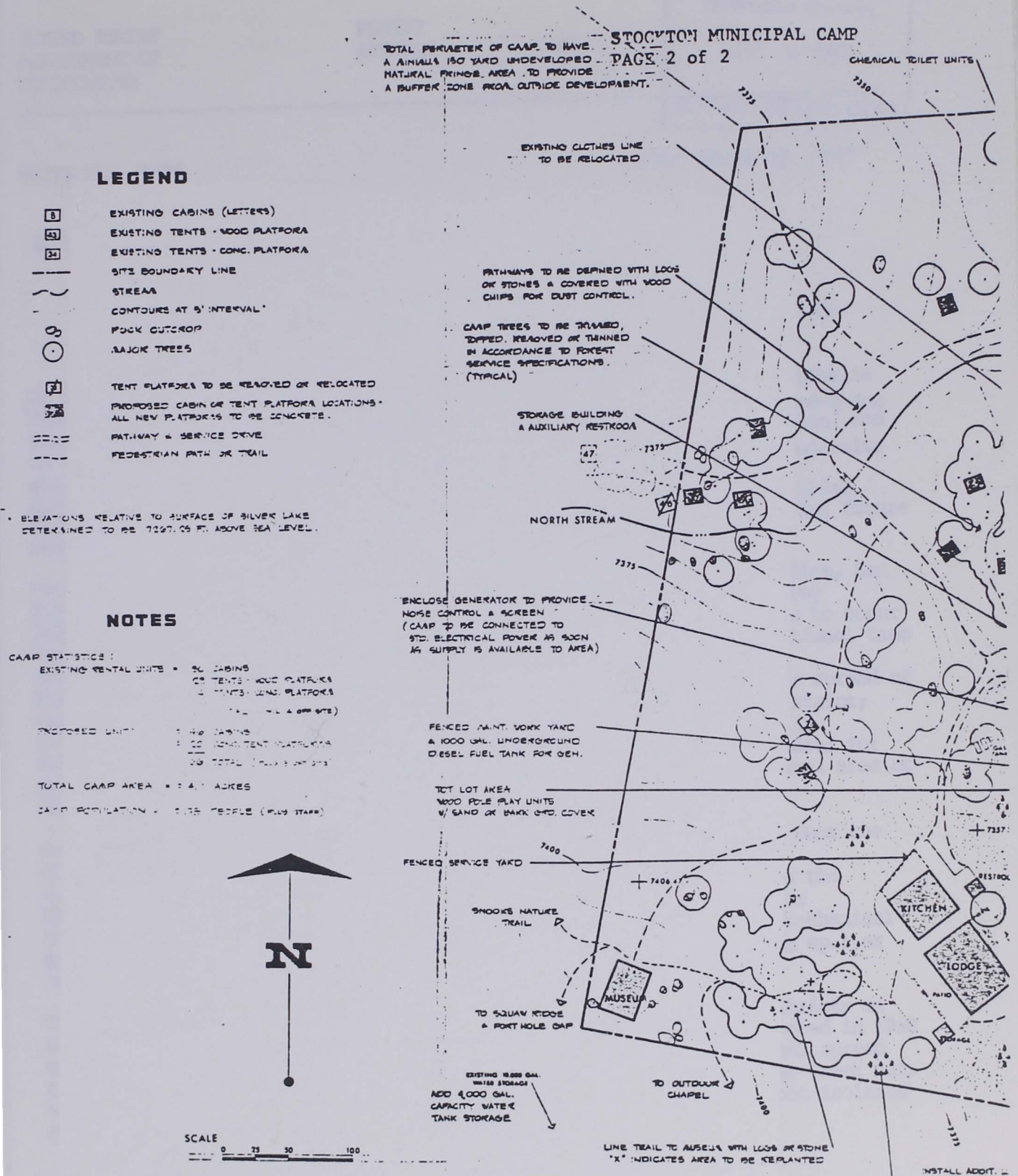

SCALE: 1" = 40'
SILVER
LAKE
PUMP
CHECK VALVE
6980
HIGH WATER ELEV.
6990
7000
7010
7020
7030
GENERATOR BLDG.
LEACH LINE
CHLORINATOR
FLAG POLE EL. 7000.00
N.E. COR. OF CAMP
STORAGE
OFFICES
WATER HTR.
SEPTIC TANK
SHOWER
CORRAL
COURSE
HILLTOP
RIDGE
5000 GAL WATER
48" CMP

PLASSES SUMMER HOME TRACT
PAGE 1 of 1




STOCKTON MUNICIPAL CAMP
PAGE 1 of 2
GROUP CAMP AREA
CONSTRUCT FORD @ STREAM (PLASSE PROPERTY)
TO PLASSE (SILVER LAKE) & HIGHWAY 88
FUTURE RECREATION AREA SEED W/ ROUGH GRASSES
GRADE & GRAVEL ROADWAY
MEADOW
LPDM
CAMP SIGN
ROADWAY & PARKING AREA TO BE DEFINED WITH LOGS OR STONE AND PAVED.
INSTALL SLEEVES FOR PORTABLE BASKETBALL STANDARDS - FOUR COURTS
FUTURE BLDG EXPANSION
SOUTH STREAM
GAME COURTS: VOLLEYBALL, BASKETBALL, TETHERBALL. SEED AREA WITH ROUGH GRASSES
REFOREST BANK W/ WILLOWS
MANAGER OFFICE
ENLARGE MANAGERS OFFICE BLDG. & ADD PATIO AREA ON EAST SIDE
PORTABLE SWIMMING POOL & WADING POOL AT STREAM
TO GRANITE LAKE
TO HIDDEN LAKE
HORSESHOE COURTS
TENTS & CABINS ON EAST SIDE OF STREAM USED BY CAMPERS COOKING THEIR OWN FOOD.
CONSTRUCT OUTDOOR TABLES & STORAGE CABINETS FOR EACH UNIT.
OPEN PLAY AREA SEED W/ ROUGH GRASSES
STORAGE BUILDING & DORMITORY
CHEMICAL TOILET UNITS
REMOVE SAND BOXES
PROGRAM CENTER & YOUTH ACTIVITY AREA
MASTER PLAN
STOCKTON MUNICIPAL FAMI
CAMP..... AMADOR COUN
DEPARTMENT OF PARKS AND RECREATION
CITY OF STOCKTON, CALIFORNIA
SCALE: 1" = 50'
APPROVED BY:

STOCKTON MUNICIPAL CAMP


TOTAL PERIMETER OF CAMP TO HAVE A MINIMUM 150 YARD UNDEVELOPED NATURAL FRINGE AREA TO PROVIDE A BUFFER ZONE FROM OUTSIDE DEVELOPMENT.
CHEMICAL TOILET UNITS
EXISTING CLOTHES LINE TO BE RELOCATED
PATHWAYS TO BE DEFINED WITH LOGS OR STONES & COVERED WITH WOOD CHIPS FOR DUST CONTROL.
CAMP TREES TO BE TRIMMED, TOPPED, REMOVED OR THINNED IN ACCORDANCE TO FOREST SERVICE SPECIFICATIONS. (TYPICAL)
STORAGE BUILDING & AUXILIARY RESTROOM
NORTH STREAM
ENCLOSE GENERATOR TO PROVIDE NOISE CONTROL & SCREEN (CAMP TO BE CONNECTED TO STD. ELECTRICAL POWER AS SOON AS SUPPLY IS AVAILABLE TO AREA)
FENCED MAINT. WORK YARD & 1000 GAL. UNDERGROUND DIESEL FUEL TANK FOR GEN.
TOT LOT AREA WOOD POLE PLAY UNITS W/ SAND OR BARK GND. COVER
FENCED SERVICE YARD
SNOOKS NATURE TRAIL
TO SQUAW RIDGE & PORT HOLE GAP
EXISTING 10,000 GAL. WATER STORAGE
ADD 4,000 GAL. CAPACITY WATER TANK STORAGE
TO OUTDOOR CHAPEL
LINE TRAIL TO MUSEUM WITH LOGS OR STONE "X" INDICATES AREA TO BE REPLANTED
INSTALL ADDIT. TO EXPAND CAMP & CONSTR. STAFF
REFOREST SLOPES & ROUGH GRASSES (TYPICAL)
KITCHEN
RESTROOM
LODGE
PATIO
STORAGE
MUSEUM
7375
7350
7400
7406
7337
1000
1375
N
SCALE
0
25
50
100

LEGEND

- [8] EXISTING CABINS (LETTERS)
- [43] EXISTING TENTS - WOOD PLATFORMS
- [34] EXISTING TENTS - CONC. PLATFORMS
- SITE BOUNDARY LINE
- STREAM
- CONTOURS AT 5' INTERVAL*
- ROCK OUTCROP
- MAJOR TREES
- TENT PLATFORMS TO BE REMOVED OR RELOCATED
- PROPOSED CABIN OR TENT PLATFORM LOCATIONS - ALL NEW PLATFORMS TO BE CONCRETE.
- PATHWAY & SERVICE DRIVE
- PEDESTRIAN PATH OR TRAIL

* ELEVATIONS RELATIVE TO SURFACE OF SILVER LAKE DETERMINED TO BE 7297.05 FT. ABOVE SEA LEVEL.

NOTES

CAMP STATISTICS :

EXISTING RENTAL UNITS = 50 CABINS
43 TENTS - WOOD PLATFORMS
34 TENTS - CONC. PLATFORMS
127 TOTAL (FULL & OFF SITE)

PROPOSED UNITS = 110 CABINS
22 CONC. TENT PLATFORMS
132 TOTAL (FULL & OFF SITE)

TOTAL CAMP AREA = 24.7 ACRES

CAMP POPULATION = 528 PEOPLE (FULL STAFF)

SILVER LAKE